Visual Roads

OVERVIEW

The method for developing proposed geometric characteristics along a given alignment begins with cross-sections of the existing surface at specified station intervals. These cross-sections are commonly called Existing Ground Cross-Sections. We then create and apply proposed roadway sections (or diagrams) to a number of consecutive stations on those cross-sections. This is considered a Proposed (or Design) Roadway Cross-Section. When we compare the proposed geometry to the existing surface, we get quite a bit of information:

- A graphical representation of the relationship between existing and proposed elements.
- The offset distance where the proposed slope intercept points are (where the outer limits of the finished roadway template meets the existing surface). This can be critical when Right-of-Way and other boundaries need to be considered.
- Square areas of any given material for quantity calculations at each station interval.
- What types of design slopes, ditches, and other roadway features may be chosen or modified to better fit with existing conditions.

We use the Visual Roads tool in CAiCE to develop proposed roadway cross-sections. Visual Roads uses object-oriented technology to provide you with a library of standard roadway elements such as lanes, slopes and structures to use for creating roadway sections. These elements, called *fragments*, are intelligent objects that modify themselves based on a combination of pre-defined conditions and user defined criteria. Because fragments are Visual Basic language routines that can access any CAiCE data or internal function, their functionality is virtually unlimited.

Your WSDOT CAiCE resources include a library of fragments designed to match typical sections and structures used by WSDOT. These address rehabilitation and widening projects as well as new highway construction. Also included are generic and other fragments to allow “free hand” design and manipulation. This library should be sufficient to define most conditions, but new fragments may be requested to handle specific situations. We’ll talk about when, where, and how you can request fragments a little later in this module.

Fragments are assembled into a typical section design with a graphical design editor. The items you need to start building a Design Roadway cross-section in CAiCE are:

- Horizontal Alignment Geometry Chain
- Vertical Alignment Design Profile
- Reference Cross Section File (.EAR), typically developed from the Existing Digital Terrain Model
- Any geometry that may be necessary to help define your design template. e.g. Superelevations, offset Chains, Right of Way Chains, etc.

- Our WSDOT resources installed on your computer
- The WSDOT VBA Fragment Library available

INTERFACE / ENVIRONMENT

In CAiCE, proposed cross-sections are defined and constructed in the *Design Roadway X-Sections* session. This is an enhanced cross-section window that includes it's own set of pull-down menus and toolbar commands. The pull-down menu is consistent with the **X-Sections => Edit / View X-Sections** interface, the difference being that all of the menu selections are enabled in this session. Along with the features previously covered in the Cross-Section Module, the Design Roadway X-Sections session includes additional tools for developing proposed sections.

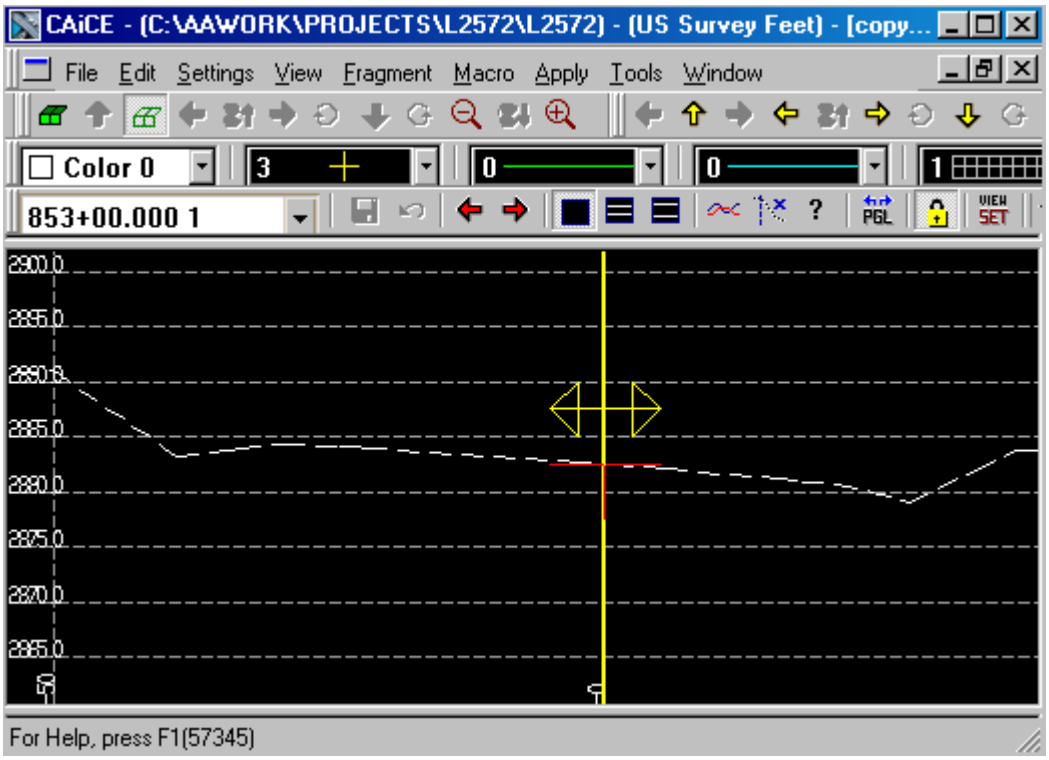


Figure **FRAG1-1:** Design Roadway X-Sections session window

When the Design Roadway session is opened, the most apparent difference from the **Edit / View X-Sections** window is the addition of left and right *hooks* in the graphics display. These indicate where the current roadway elements will be applied. The graphic window also contains a red cross-hair that indicates the currently referenced design vertical profile.

For designing roadway sections, we have tools that allow you to access the fragment library, choose where we want them to go, and insert them.

EXERCISE 1 - GETTING STARTED IN CAICE

To start out at this lab, browse to ***C:\CAE_rsc\Training\CAiCE\Roadway_Design\07_Visual Roads*** and un-archive ***L2572_VR1 Fragments.zip***. Verify that the appropriate feature table (L2572.ftb) and cell file (WAEState.ccl) are attached.

In this section, we will start the design process by specifying the cross-section file, the horizontal and vertical alignments, and the name of the final design endarea to be created.

1	Open CAiCE using the VBA fragment library by clicking on the CAiCE desktop icon
2	In the **WSDOT CAiCE** startup dialog choose the **VB** Fragment library radio button and click the **Start CAiCE** button

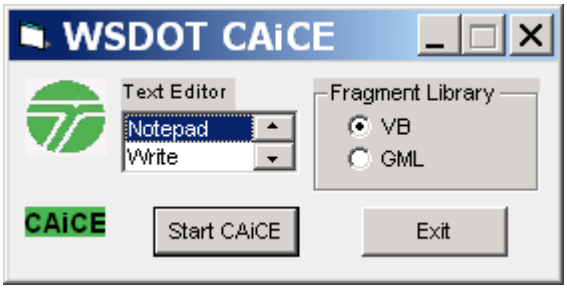


Figure **FRAG1-2:** WSDOT CAiCE Start up dialog

The following items have already been stored for these exercises:

- Input (reference cross-section) file: **C:\AAwork\Projects\L2572\sr97ex.ear**
- Geometry (horizontal) alignment chain: **SR97**
- Design profile: **SR97**

3	To access the Design Roadway X-Sections window, select **X-Sections => Design Roadway X-Sections** CAiCE displays a dialog box that asks for a reference file, proposed file, and boundary chain information
4	Select the **X-Sections => Design Roadway X-Sections** command to open the Design Roadway X-Sections Input dialog box
5	In the **Input File** field, *click* on the **Files…** button to activate the Design Roadway X-sections - Open dialog box

DESIGN ROADWAY X-SECTIONS INPUT

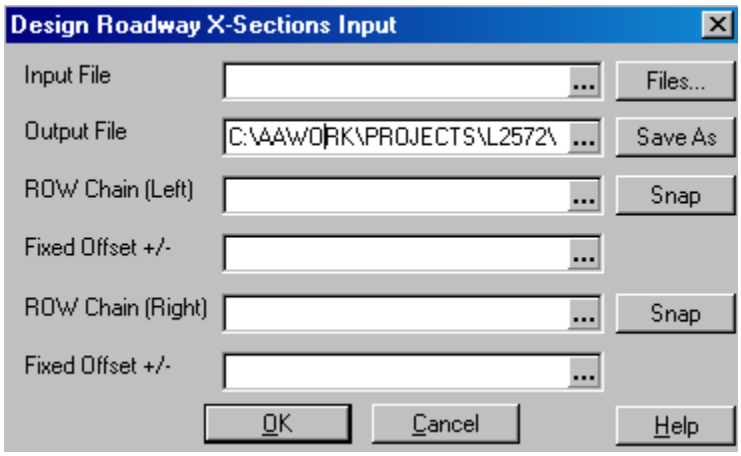


Figure **FRAG1-3:** Design Roadway X-Sections Input dialog

6	*Select* the ***sr97_exist.EAR*** and then *click* on the **Open** button
7	In the Output File field change *UNTITLED.ear* to **sr97_fin.ear** or use the **Picker Control** or **Save As** buttons.
8	In the **ROW Chain (Left)** field type **ROW1** In the **ROW Chain (Right)** field type **ROW2** - this will show us where the existing right of way is located on the cross-sections
9	Verify the input items, then *click* **OK** If the output file ***sr97_fin. EAR*** exists, you will be asked whether to overwrite it. If so, *click* **Yes** to display the Profile Grade Line Input dialog box

The **Input File** is the name of the existing ground surface data endarea file (.ear). You can type the path and name in directly, use the **Picker => File Open** command, or the **Files…** button to choose the reference cross-section file.

The **Output File** is the name of the end-area file (.ear) that will contain the computed design surface data. You may type in the file name or select it with the **Save As** command.

> **TECH TIP**: Using a short, concise, intuitive, and consistent naming convention will make this process go a lot smoother. Typically, we recommend the name of the alignment chain with the type of endarea data, separated by an underscore. For example, an endarea that represented the existing surface would be "CL1_ex.ear". An endarea that represented the proposed roadway would be "CL1_fin.ear"

The **ROW Chain (Left/Right)** and **Fixed Offset +/-** fields allow you to enter the name of the geometry chain or offset value that defines the right-of-way or boundary line along the left side of the base line. For ROW fields, you may type in the chain name or select it using the snap process. With the fixed offset fields, type in a value. Offsets made to the left of the alignment center line must include a negative sign.

Selecting **OK** brings you to the Profile Grade Line (PGL) input dialog, which allows you to set the active design alignment and profile. This Profile Grade Line (PGL) is the "origin" of all fragments

used in the design. When using superelevation tables, this is where it references which superelevation table to use.

PROFILE GRADE LINE INPUT

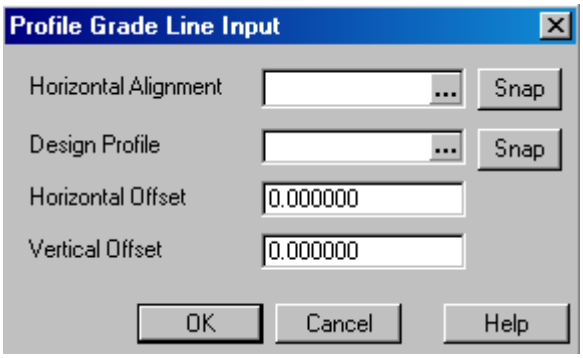


Figure **FRAG1-4:** Design Roadway X-Sections Input dialog

The **Horizontal Alignment** field contains the name of the geometry alignment chain that defines the center line or the base line. You can type the name in directly or use the picker commands or the **Snap** button to select the geometry chain.

The **Design Profile** field contains the name of the vertical profile to be used in the design. You may type in the design profile name or select it with the snap process.

The **Horizontal Offset** shifts the insertion point horizontally from the actual PGL. This horizontal shift effectively moves the PGL without re-computing a centerline or a vertical profile.

The **Vertical Offset** shifts the insertion point vertically from the actual PGL. This vertical shift effectively moves the PGL without re-computing a centerline or a vertical profile.

Select **OK** and you are ready to start using Fragments.

10	In the **Horizontal Alignment** field type **SR97** In the **Design Profile** field type **SR97**
11	Verify the input items then *click* **OK** to display the Template Design screen
12	Browse the Visual Roads session interface components
13	Close the session using **File => Close**

FRAGMENTS

OVERVIEW

A fragment is a small Visual Basic for Applications (VBA) program that inserts something or causes an action to take place depending on the input you give it. Typical fragments in our library are WSDOT standard roadway elements (lanes, shoulders, curbs, sidewalks, barriers, retaining walls and side slopes). While drafting a roadway section for your project, you usually ask yourself "What elements do I want the construction crew to include for this station range?"

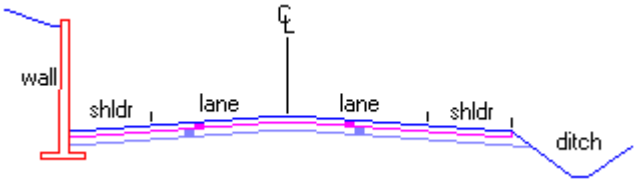


Figure **FRAG2-1:** Roadway Section diagrams help show what roadway elements – or fragments - are needed.

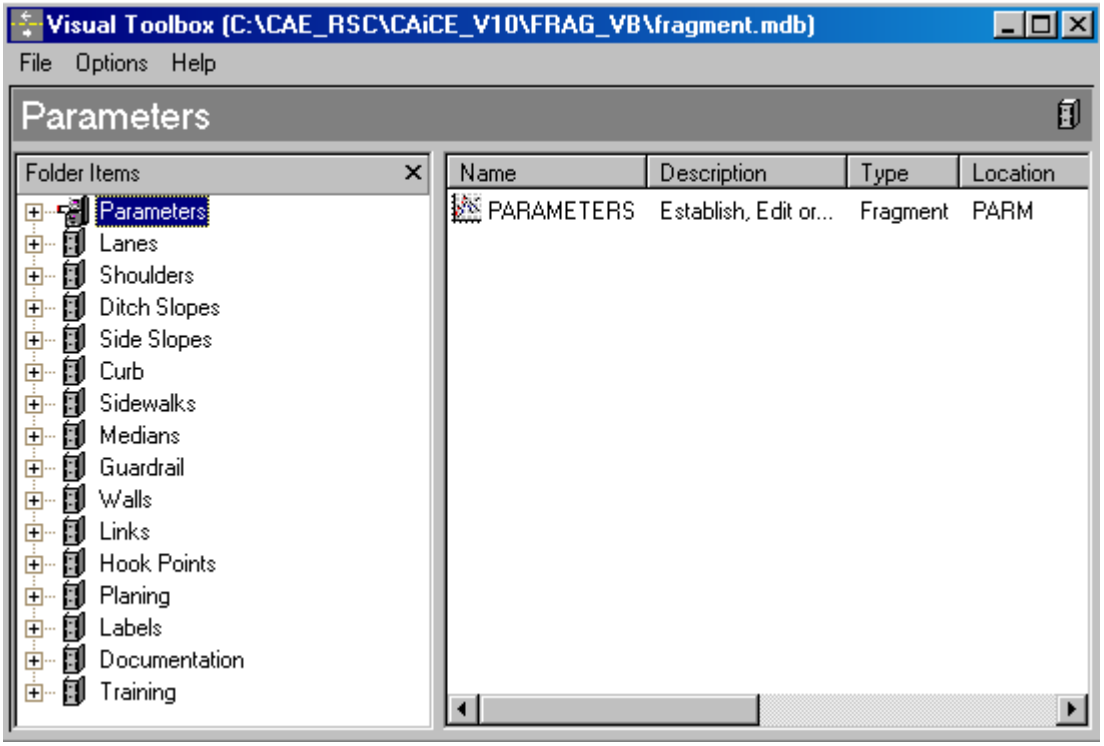
This chapter will introduce you to our fragment library, including some of the more commonly used fragments in the sequence that one would use to complete the typical Roadway Section template. You will also learn the process for selecting and inserting fragments into a cross-section file, and the dialogs and choices that are associated with this process.

Our fragments are organized into categories to achieve different basic functions in a roadway section. Each category has a number of fragments to choose from. All fragments within a category have common functional characteristics.

For example, each of the **LANE** fragments act similarly in that they all compute a width of full depth roadway containing a preset number of roadway materials. What makes one **LANE** fragment different from another is the criteria used to define how it gets there.

FRAGMENT TOOLBOX

The fragments are accessed from a Fragment ToolBox. The fragment categories are organized in a tree hierarchy.



FRAGMENT CATEGORIES

Fragments are currently broken into these basic categories:

- Parameters
- Lane
- Shoulder
- Curb/Gutter combinations
- Curb
- Sidewalk
- Cut/Fill combinations
- Cut
- Fill
- Slopes
- Links
- Hook
- Median/Gore
- Guardrail
- Walls
- Planing
- Labels

We will discuss the parameter fragment in-depth, as the utilities in this fragment are specific and necessary for most other fragments to work properly. Next, we will introduce representative fragments from other categories. All fragments in a given category perform the same basic function - the input criteria sets each fragment apart from the others.

A complete list of current fragments can be found at the end of this module.

PARAMETERS

The PARAMETER fragment includes four categories that store frequently used information for the other fragments. For example, the mainline roadway materials may be input once with a layer fragment and referenced by all the roadway fragments.

- **Common/Text** – labels text settings and error reporting options
- **Layer Depths** – contains material layer depths
- **Surface Names**– contains surface names
- **Slope Criteria** – contains catch slope fill and cut criteria

COMMON / TEXT TAB

The Common/Text tab in the Parameter fragment allows you to set the default text heights and angle at which the text will be displayed for all fragments. Almost all fragments give you the option to label the controlling points (for example: where the hook point will be once the fragment has been inserted) with offset and elevation information and slope value across the fragment.

Also, you may choose to display fragment application errors as they occur. Regardless of the "Show Errors" choice, the WSDOT fragment system saves error messages to a *.log file in the project directory. The log file has the same name as the endarea file you are working in.

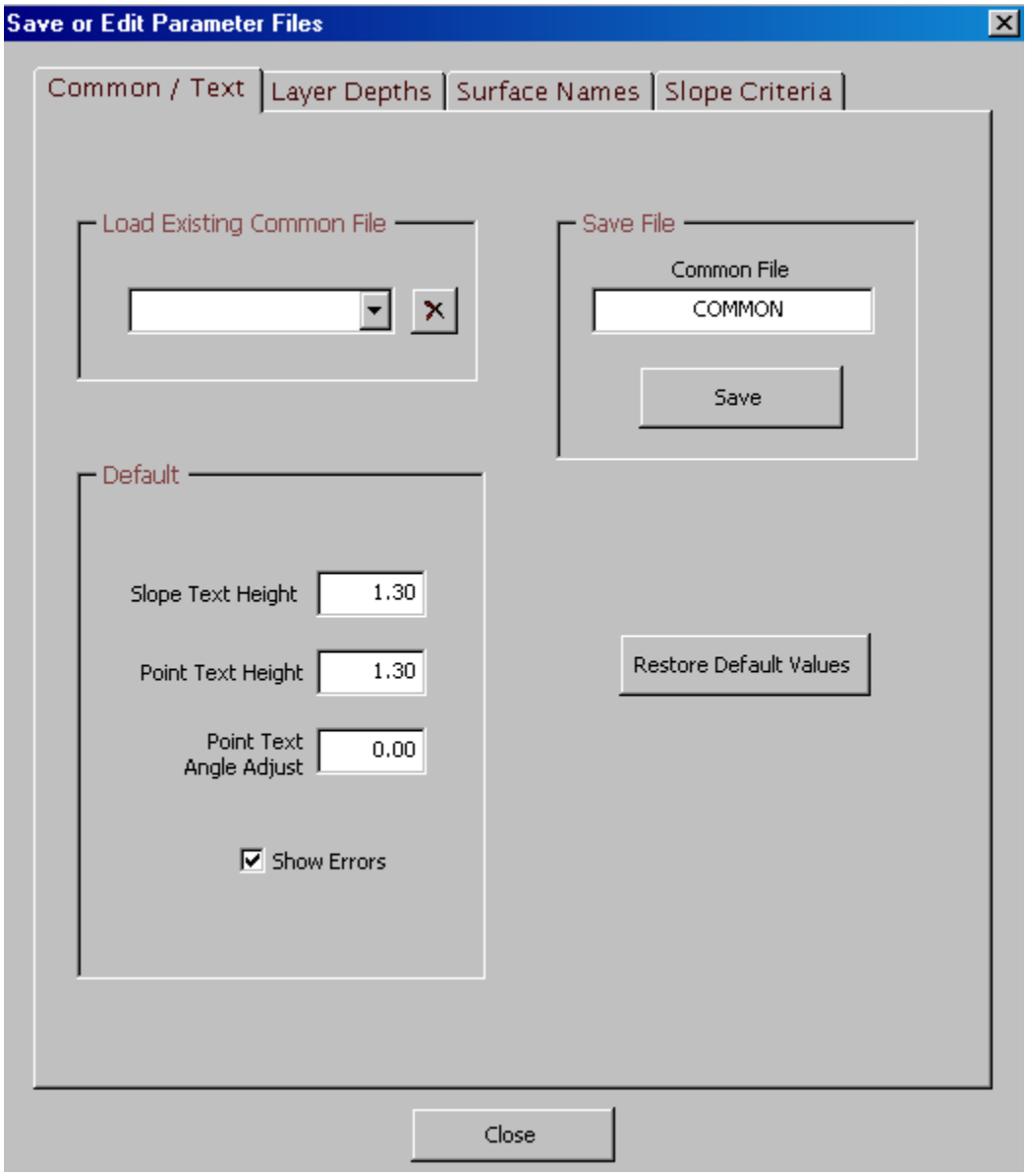


Figure **FRAG2-2:** Common/Text Parameter tab dialog box

The **Load Existing Common File** drop-down box allows you to load a common file from your project folder. This file displays the Slope Text Height, Point Text Height, Point Text Angle and Show Error values. You can also delete an existing common file here.

When we created the L2572 tutorial project we applied the **Copy Project Files** macro from the CopyProjectFiles Toolbox. This loaded several common parameter files for various text heights into the PRM subfolder in your project. The default common/text file is **COMMON**.

Point Text Angle Adjust gives you the opportunity to adjust the text angle. If left at 0, text will be displayed at 90 degrees.

Uncheck **Show Errors** if you do not want to see informational message boxes (for example, a message box indicating that finished shoulder is outside the ROW limits). Leaving this common file box unchecked might be helpful for situations when you are applying a fragment that will be used as a template, so that non-critical messages do not interrupt the process. Critical error messages, which display an error when the fragment cannot properly run, are displayed regardless of this setting. All

errors are appended to an error log in the project folder under the name of the design output file (*Outputfile*.log). Click the **Save** button to save the Common File filename to the current project folder.

Click the **Restore Defaults** button to re-establish the default values for the text and checkbox, which can then be edited or saved to a file.

> **TECH TIP:** You may use a different name than "Common" for your project common parameter file. You could even have more than one common fragment for your project. Maybe you want labels for different plot scales. When deciding on your naming scheme, there are two recommendations:
>
> a. Keep it short, simple, and intuitive
>
> b. Remember the three "D's"…. Document, Document, Document

LAYER DEPTHS

The **Layer Depths** parameter tab saves roadway material depths to a file in the project directory. Default layer depths parameter files are available in the PRM subfolder in your project. Layer information is saved separately for three different types of roadway elements:

- **Lanes** – for roadway depths inside the Traveled Way
- **Shoulders** – for roadway depths outside the Traveled Way to the Edge of Paved Shoulder (EPS)
- **Slopes** – for slope design starting at the EPS toward the catch limit

The designer can then reference the appropriate layer file, rather than entering each individual depth when using fragments that construct layers.

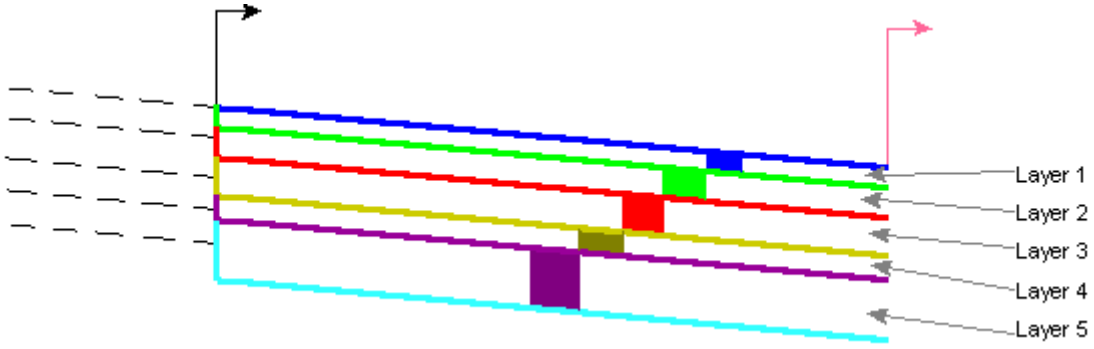


Figure **FRAG2-3:** Layer elements

As with previous versions of WSDOT fragment libraries, the layer parameter fragment allows for five possible roadway material layers. By default, the upper limit of layer 1 (L1) is designated ***FIN*** for FINished ground, and the lower limit of layer 5 (L5) is designated ***SUBG*** for SUBGrade surface.

When dealing with less than 5 layers in your design, it is HIGHLY recommended that you have a value for L1 and L5 and zero out any combination of L2, L3, and L4. Not adhering to this convention will result in frustrating material quantity extraction.

Similarly, when saving a set of layer depth fragment files with less than 5 layers, you should zero out the same layers for the lane and shoulder types as well as keep the same layer configuration through to the slope type. This ensures that your roadway material areas can be defined effectively.

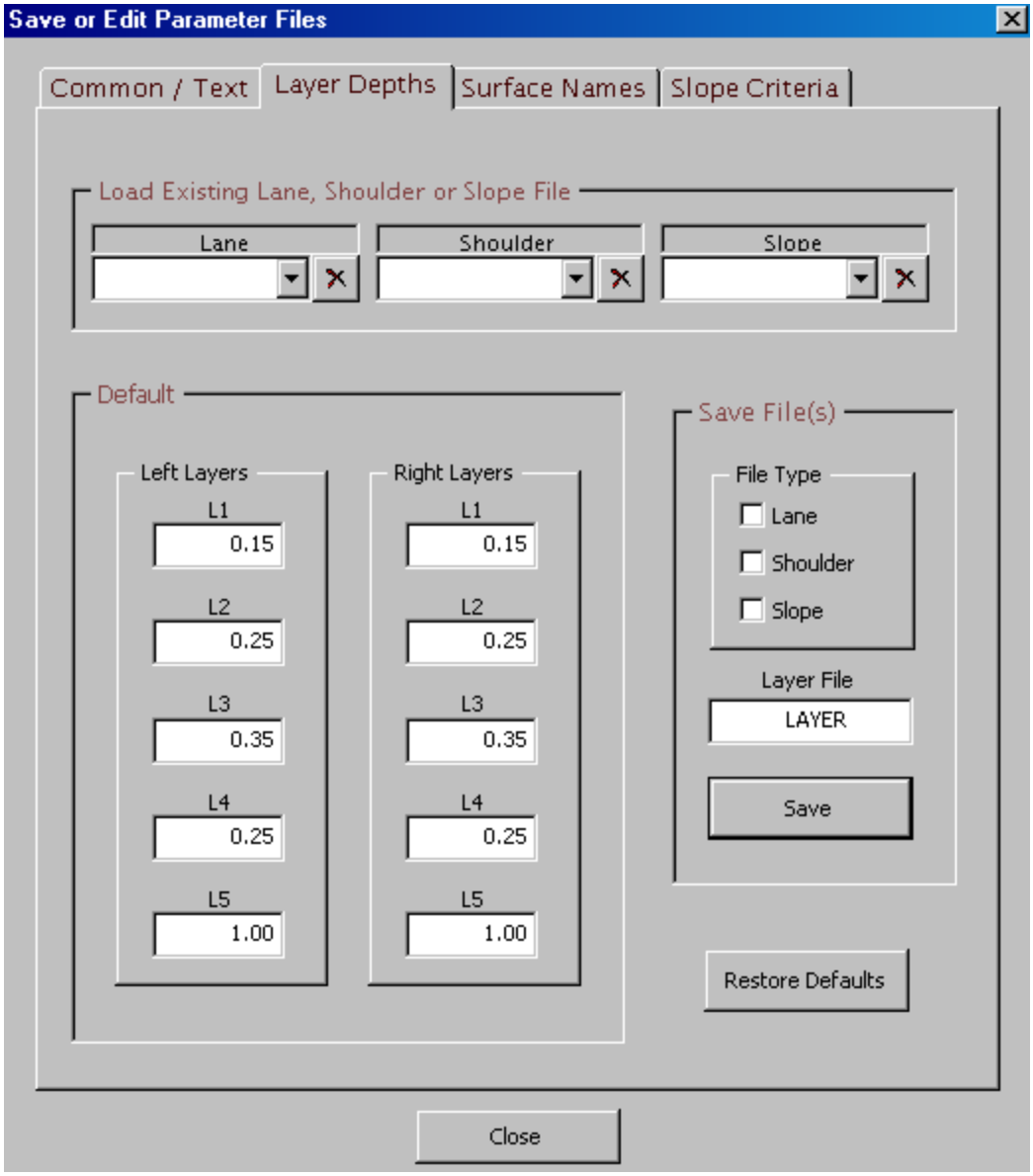


Figure **FRAG2-4:** Layer Depth criteria dialog box

The layer depth parameter dialog allows you to have separate values for the left and right side scenarios.

There are **L1**-**L5** fields for both the left and right sides of the road. When the form initially loads, it displays default values for each of the fields. Click the **Save** button to save the values into a **Lane** thickness file, a **Shoulder** thickness file and a **Slope** thickness file, depending on which file types are selected.

Use the drop-down boxes in the **Load Existing Lane, Shoulder or slope File** area to access existing Layer Depth files in your project. This load the values from the Layer File/Type specified into the L1-L5 fields. You can also delete layer depths files from this area.

Click the **Restore Defaults** button to re-establish the default values for the L1-L5 fields, which can then be edited and saved.

A minimum of three layer parameter fragment files need to be available in your project's PRM subfolder - one for each file type. For example, you may have a set of layer fragments that you called **MAIN**. In the PRM subfolder in your project, three files will be saved called:

MAINLL.prm	for lane fragments
MAINSL.prm	for shoulder fragments
MAINEL.prm	for earthwork (ditch slopes, etc.)

To expand on the minimum, you could then include in your project a set of layer fragments for the **A-line** ramp where a different material layer configuration is needed. By typing **Aline** in the **Layer Name** field for each file type, the following files would be saved in the project directory:

AlineLL.prm	for A-line lane fragments
AlineSL.prm	for A-line shoulder fragments
AlineEL.prm	for A-line slope fragments

Default layer depth parameter files are available in the PRM subfolder in your project. These are **LAYEREL**, **LAYERLL** and **LAYERSL**.

SURFACE NAMES

Much like it's layer counterpart, the **Surface Names** parameter tab saves roadway surface names to a file in the project directory. Surface information is also saved separately for three different types of fragments: **Lanes**, **Shoulders**, and **Slopes**. The designer can then reference the appropriate surface file, rather than entering each individual surface name for each fragment used.

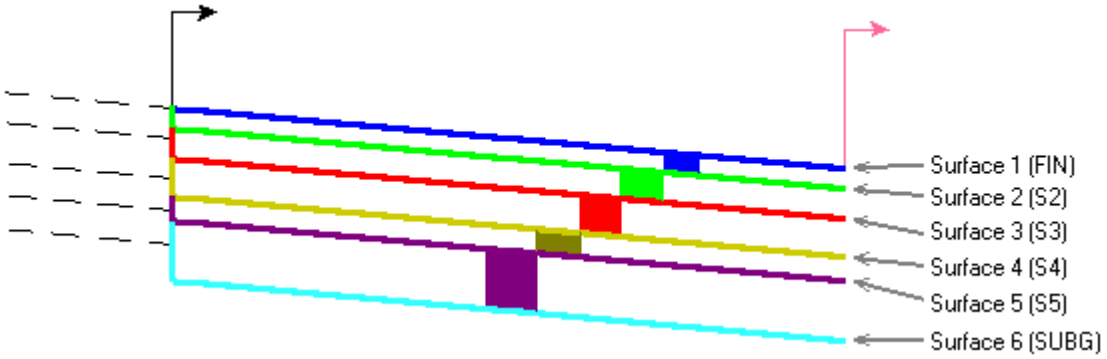
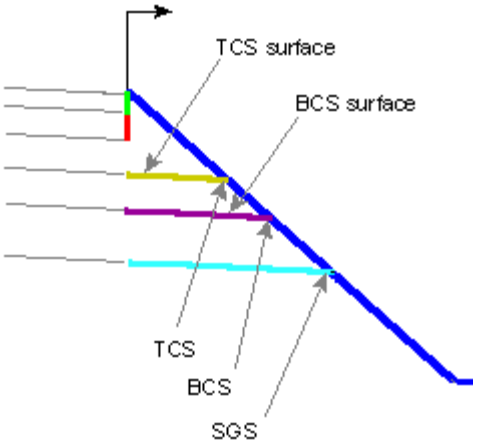


Figure **FRAG2-5:** Surface Name elements

The surface name parameter tab allows for six possible roadway material surfaces. By default, the uppermost surface is designated **FIN** and the lowermost possible surface is **SUBG**. It is recommended that you keep these values as their defaults in order to make it easier to calculate quantities later.

> **TECH TIP:** Changing the names of roadway surfaces here makes defining material quantities more specific and readily apparent, but also more difficult if you do not change each future reference accordingly. Sticking with the defaults is recommended until you are very comfortable with the environment.

When you select the slope file type, you can also indicate which surfaces you wish to tie the Top Course Shoulder (TSC) and Base Course Shoulder (BSC). These surfaces correspond to material surfaces that would meet the ditch slope other than the subgrade.



Note: L1 and L2 are set to 0.0 thickness

Figure **FRAG2-6:** Top Course Shoulder (TCS) and Base Course Shoulder (BCS) points.

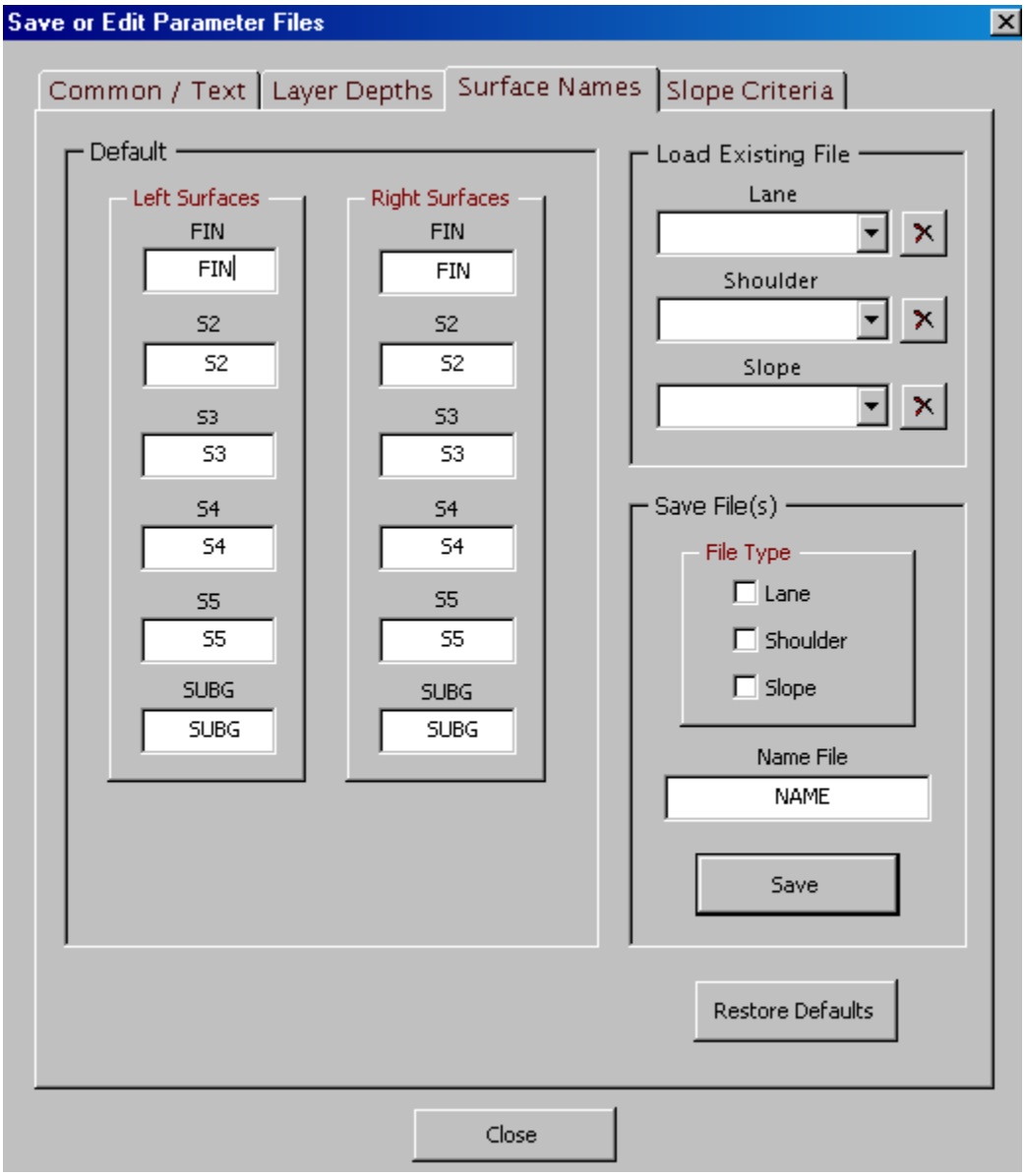


Figure **FRAG2-7:** Surface Name criteria dialog box – Slope shown

As with the layer depth parameter files, you can have different surface names for the left and right side scenarios.

There are surface name fields for both the left and right sides of the road. The **TCS** and **BCS** Layers are only used when saving or editing a Slope file type.

When the form initially loads, it displays default values for each of the fields. Click the **Save** button to save the default values into a **Lane** surface name file, a **Shoulder** file and a **Slope** file, depending on which file types are selected. They may all be saved under the same name, regardless of the values, since they will be different file types. The default surface name files in the PRM subfolder are **NAMEEN**, **NAMELN** and **NAMESN**.

Select existing lane, shoulder and slope files by using the drop-down box in the **Load Existing File** area. You can also delete existing files from this area. Click the **Restore Defaults** button to re-establish default values to the fields, which can then be edited and saved.

SLOPE CRITERIA

The **Slope Criteria** parameter tab allows the designer to input the design catch slope criteria for specific project requirements.

There are fragments that figure out when the relationship between the proposed roadway section and the existing surface changes from a fill situation to a cut and act accordingly. These are very flexible fragments that can be used for a large range of stations without manually changing the criteria.

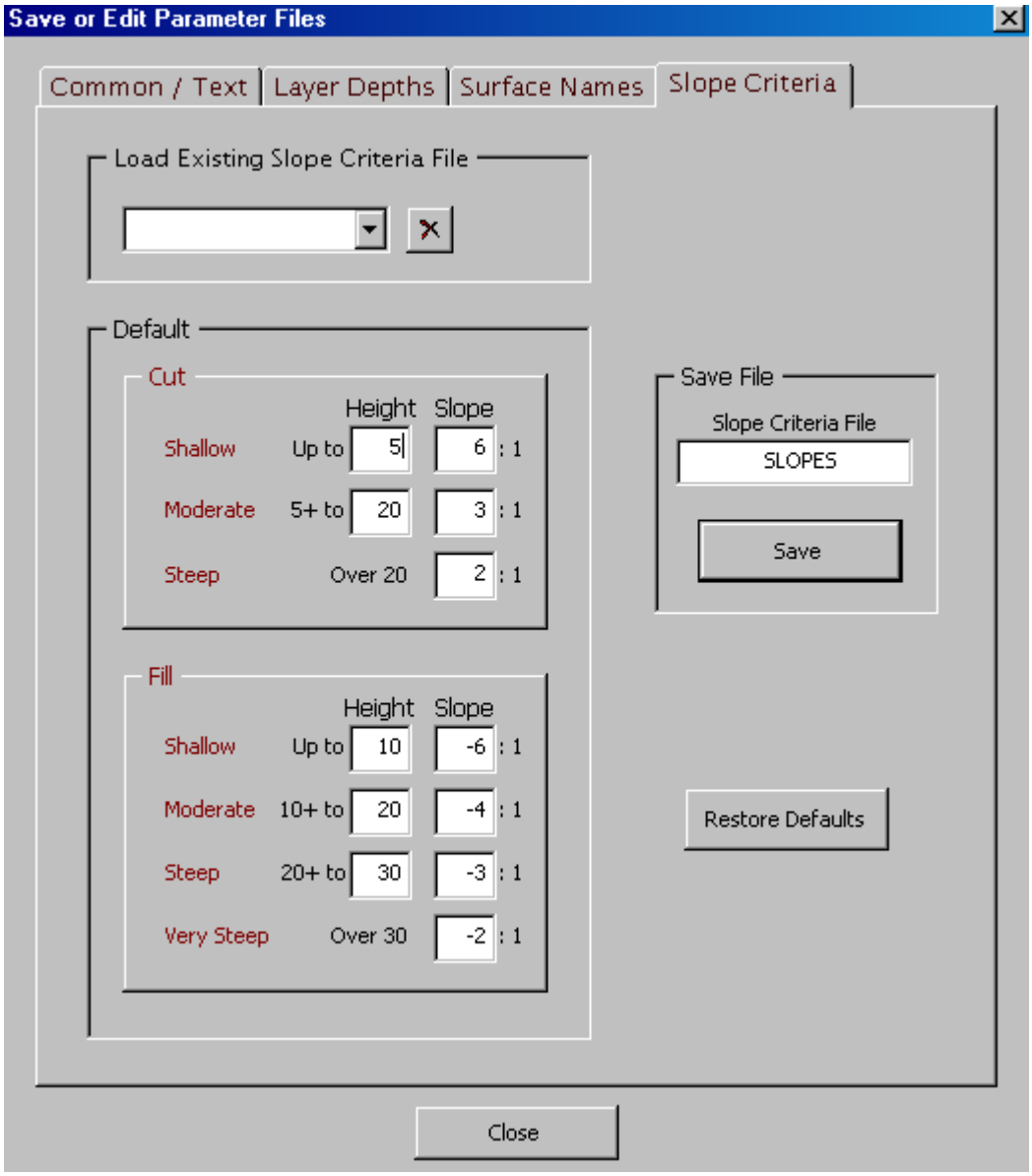


Figure **FRAG2-8:** Slope criteria input dialog box

In figure FRAG2-8, the default CUT values specify that when the back slope catches less than **5** ft/m (Shallow Cut) above the Ditch Bottom (DB), the back slope ratio will be **6**:1.

Any catch between 5 and **20** ft/m (Moderate Cut) above the DB would be a **3**:1 slope and anything higher (Steep Cut), a **2**:1 slope.

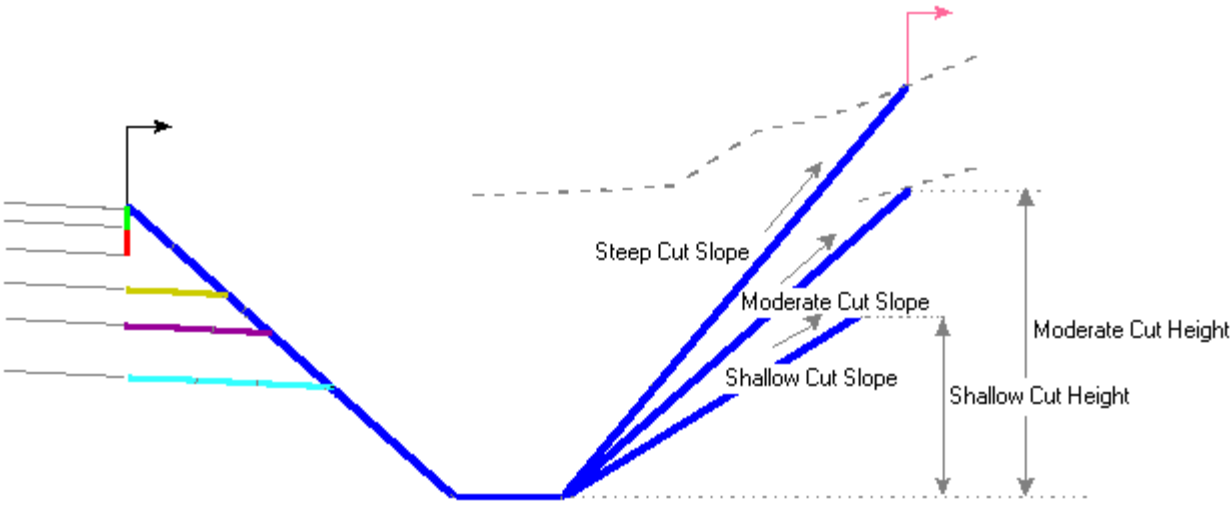


Figure **FRAG2-8:** Slope criteria in CUT scenario

The default FILL criteria works similarly. A shallow fill is defined as from 0 to 10 ft/m below the EPSP; a moderate fill would be 10 to 20 ft/m; and so on.

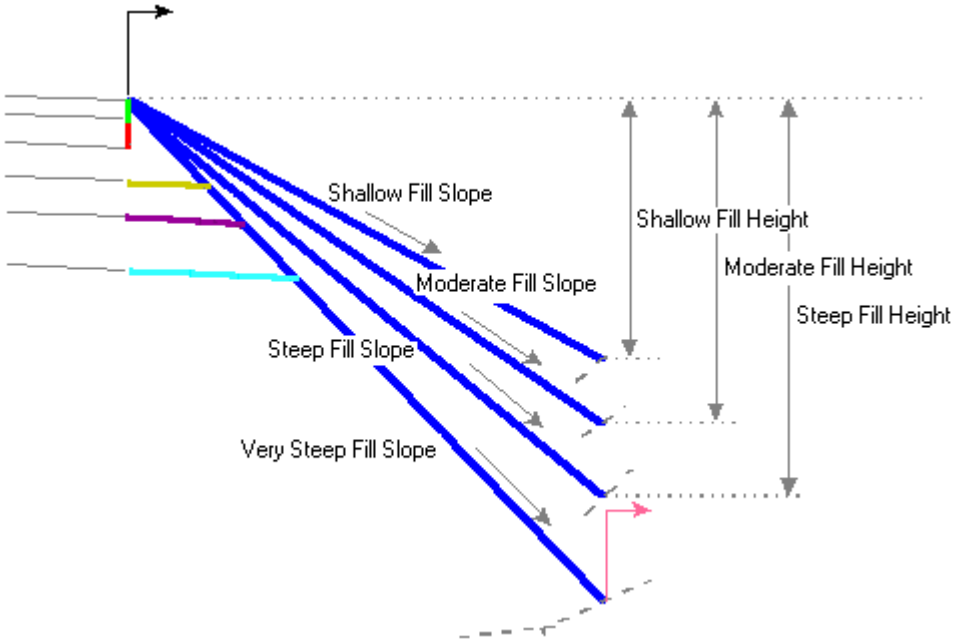


Figure **FRAG2-9:** Slope criteria in FILL scenario

Click the **Save** button to save the default values into a slope criteria file.

Use the drop-down box in the **Load Existing Slope Criteria File** area to select an existing file and load the values from the specified Slope File into the slope criteria fields. You can also delete slope criteria files from this area. Click the **Restore Defaults** button to re-establish default values for the fields, which can then be edited and saved.

> **TECH TIP:** For multiple slope configurations, it is recommended that you use a naming convention that includes the configuration and the word "SLOPES". For example, you may have *MAIN_SLOPES.prm* and *ALINE_SLOPES*.

Slope criteria parameter files are available in the PRM\Slope subfolder in your project. The default file is **SLOPES**, and there are also slope parameter fragments named **1**, **2**, **3**, **4**, and **6**.

ROADWAY FRAGMENTS

All lane and shoulder fragments are similar - each defining the applied superelevation in a specific way. All roadway fragments allow you to mark key points and features. These fragments rely on the parameter files discussed earlier in this chapter to function.

LANES

LANE fragments construct a user-defined width of five possible roadway materials. The intent of this fragment group is to indicate conditions inside the limits of Traveled Way.

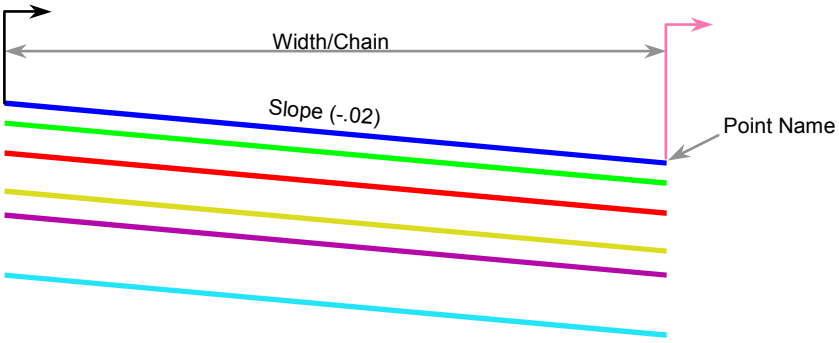


figure **FRAG2-10:** A simple Lane Fragment (LANEWS).

There are options to indicate the width of the fragment – either by a numeric value, or using a stored offset chain; cross-slope criteria, conditional behavior, and marking the end point for later use. Layer depths, surface names, and common/text parameter files are also required.

Deciding on which lane fragment to use depends mainly on how you want it to calculate the relative elevation difference (slope) to the end point.

For example, if you want a specific superelevation, use **LANEWS**. With this fragment, you can enter a superelevation or use a stored superelevation table for the alignment you are using.

When using lane fragments that utilize superelevation tables, the values in the table's SE Rate Left/Right columns are applied.

If the intent is to match the existing, then the **LANEWC** fragment will do the trick. This fragment checks the elevation of a surface at a given distance and calculates the slope from where you are to there. It then projects that slope to the width you wish the fragment to go.

Alternative roadway fragments to the lane category include **PLANING** fragments.

SHOULDERS

SHOULDER fragments also construct a user-defined width of five possible roadway materials. The intent of this fragment group is to indicate the roadway portions outside the limits of Traveled Way. These fragments rely on the parameter files discussed earlier in this chapter to function.

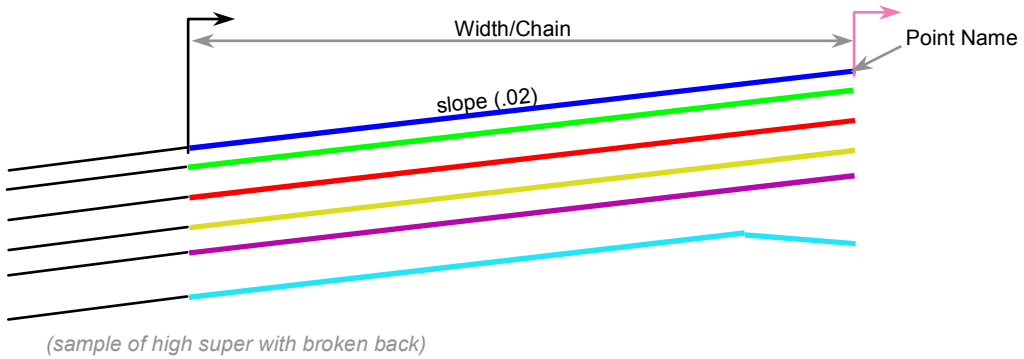


figure **FRAG2-11:** A simple Shoulder Fragment (SHLDWS).

There are options to indicate the width of the fragment – either by a numeric value, or using a stored offset chain, cross-slope criteria, conditional behavior – including broken back shoulders, and marking the end point for later use.

When using shoulder fragments that utilize superelevation tables, the values in the table's Shoulder Rate Left/Right columns are applied.

Alternative shoulder fragment types include **CURB/GUTTER**, **CURB**, and **GUARDRAIL** category fragments.

SLOPES

Ditch slope fragments are broken up into two categories: **Cut Or Fill** and **Cut**. Side Slopes are broken up into two categories: **Fill** and **Slopes**. These fragments rely on the parameter files discussed earlier in this chapter to function.

They are intended to handle a majority of the standard conditions between the Edge of Paved Shoulder Proposed (EPSP) and the catch to the existing surface. All of the slope fragments assume that the hook point is at the end of a shoulder fragment prior to insertion.

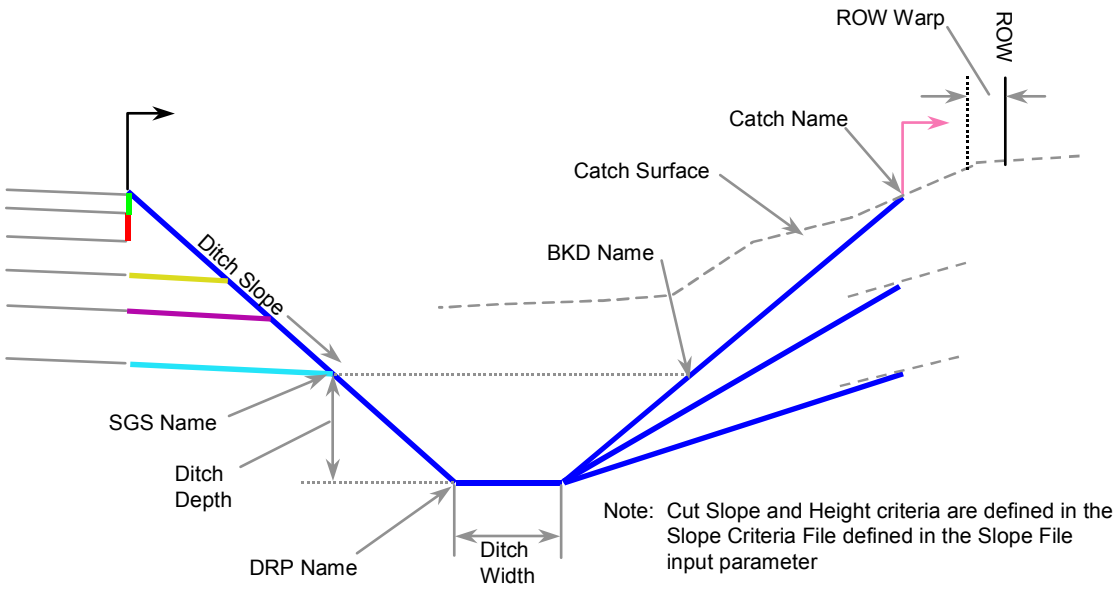


figure **FRAG2-12:** A standard CUT/FILL Fragment (CTFLSDSC).

These fragments allow the user to close certain materials at the EPSP and continue others out to the ditch slope. They can build a slope to the Ditch Reference Point (DRP) or continue with a back slope to catch an existing surface. All slope fragments allow you to mark key points and features.

Some slope fragments allow the catch slope to be warped to fit additional criteria regarding the boundary limits imposed on the endarea. As the slope catch approaches the ROW boundary, the options are to warp inside the limit by a distance, at the limit, or outside the limit by a distance.

CUT/FILL fragments are the most flexible of the slope categories. As the reference or existing surface changes along a roadway, the behavior of these fragments will change accordingly. When the proposed roadway is above the existing surface, the fragment will effect a FILL solution. As the roadway moves below the existing surface, the fragment switches to a CUT solution with potential ditch options included. This flexibility allows many stations to be defined by one slope fragment.

CUT and **FILL** fragments force a CUT or FILL solution depending on the category regardless of the relationship between the proposed roadway and the existing surface.

Slope fragments allow simple links for ditch slopes using various criteria to define the length and slope of the fragment. They may vertically close off all surfaces at the EPSP in a cut scenario, or extend layers to the ditch slope in a fill scenario.

Alternative slope fragments include fragments in the **MEDIAN/GORE** categories.

WALL FRAGMENTS

This category includes MSE, “Econo-Block”, Soldier Pile, and standard plan retaining walls. These fragments require a surprisingly small number of input criteria values for a comprehensive output. Most of these fragments account for structure excavation, shoring and cribbing, retaining wall materials, backfill materials, as well as adjacent roadway materials. These fragments rely on the parameter files discussed earlier in this chapter to function.

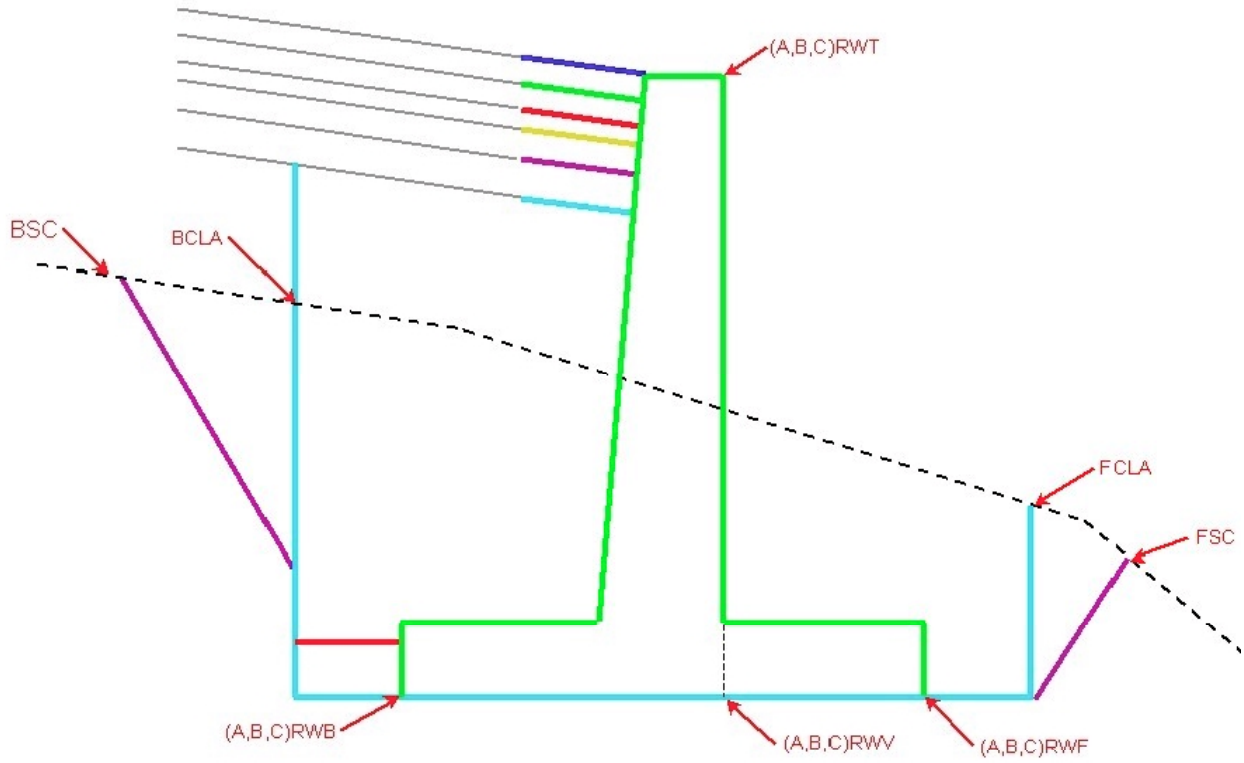


Figure **FRAG2-13**: Typical Retaining Wall fragment.

LINK FRAGMENTS

LINK fragments allow you to apply simple point-to-point links. These links can be controlled by distances, chains, slopes, profiles, an marked points from other fragments.

For example, if you have a custom cast-in-place barrier in your project, you may “draw” it with these fragments based on the dimensions.

HOOK FRAGMENTS

HOOK fragments manipulate the hook points themselves. This may be very useful when widening from a sawcut on the left side of the roadway, then switching to the right side.

The hooks can be moved using a number of criteria including a feature on a surface, a chain, an offset or distance, or a marked point from another fragment.

Templates

So far in this module, we have discussed the Visual Roads environment, and familiarized ourselves with the WSDOT Fragment Library, effectively setting up the workspace and organizing the tools we will use. The task ahead is to develop proposed endarea cross-sections in order to provide a comparison between existing conditions and proposed design.

There are three important concerns when planning out this procedure:

- Accurate staking information for construction and survey
- Accurately represent the proposed design at each station
- Allow for accurate quantity calculations for each station

We will start by combining fragments together to apply a roadway section to a single station. A typical section is constructed by selecting and inserting a sequence of fragments with the input parameters adjusted to meet your design criteria.

While the interactive selection and insertion process has several advantages from the ease-of-use and control aspect, it quickly becomes tedious having to select and insert the same sequence of fragments at multiple stations.

We will discuss the options available to apply those fragments to other stations. The most effective option is the Template.

This chapter will step through the process of selecting and inserting fragments at a single station, modifying or manipulating fragments graphically, and saving a station template. Once a station template is saved, we can run the template on a number of stations. The entire set of stations can be recorded and saved as a Design template. Both templates can be modified in a text editor for broad changes.

First, lets look at one station…

A good habit to get into is sketching out the roadway section you are planning on building before you begin. Include the centerline chain and profile along with the offset geometry that will be used to develop the section.

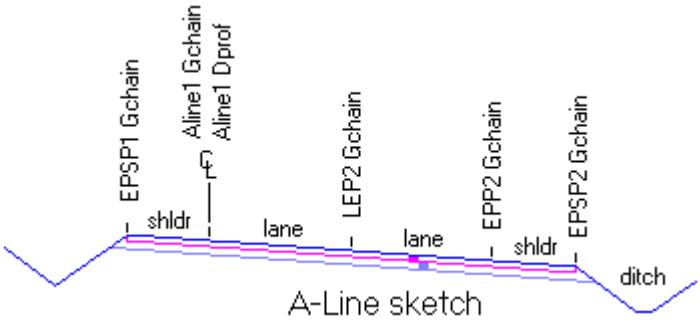


Figure **FRAG3-1**: Sketching out the roadway section is a great way to keep focused.

This allows you to keep control of the section development. Using it as a reference also minimizes the need to go back to the plan view graphics display to figure out what the name of that offset chain really was.

FRAGMENT DESCRIPTIONS

For each fragment provided in the standard WSDOT Fragment library, there is a corresponding description file. The description file describes what the fragment is used for, its input parameters as well as the logic, action, and behavior of the fragment.

The description files can be accessed from the \FRAG_VB\Desc folder in your CAE_RSC resources. When you select a fragment in the Fragment Toolbox, the description file is displayed.

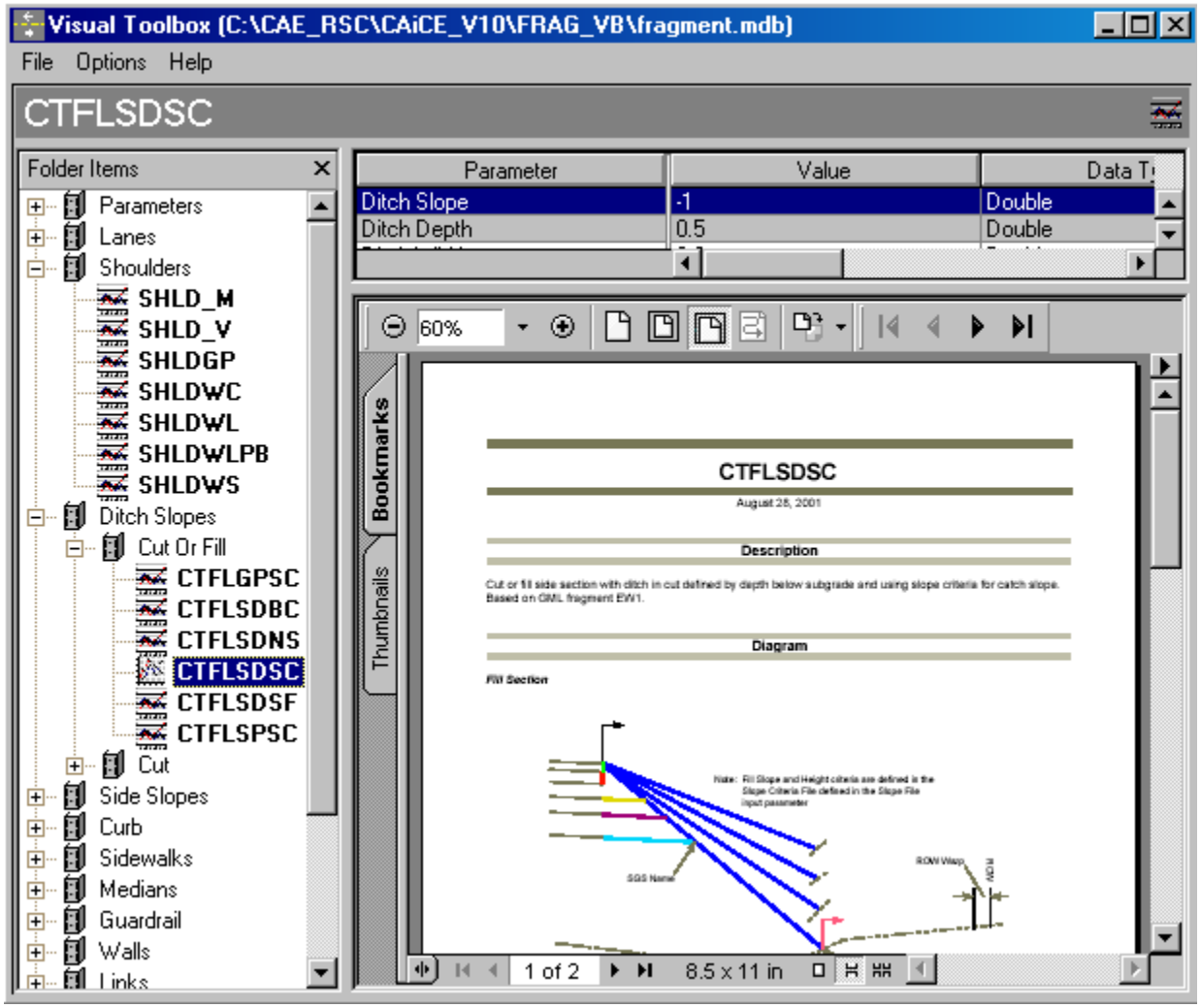


Figure **FRAG3-2:** A Fragment Description file

When in doubt, use the description files to help you find which fragment would work best for your situation.

INSERTING A FRAGMENT

When you select the parameter fragment, follow the instructions in the fragment input field and *double-click* on the fragment or *right-click* and select **Insert**. This will display the Save or Edit Parameter Files dialog box. Insert this fragment if you are using any non-default parameter files.

With the exception of the parameter fragment, most fragments are inserted at the current hook point positions. Before you insert the current fragment you must define which hook point the insertion will take place at.

The terms “left” and “right” do not necessarily mean that the surfaces are inserted left or right of the baseline. The two hook points may be located at any offset and elevation. A “right side” insertion means that the surfaces are inserted to the right beginning at the right hook point location - even if it happens to be at a negative offset. The left and right designations also affect surfaces that super elevate. Typically it uses the left side superelevation slope for that station if one of these surfaces is inserted using the left hook point. One inserted on the right uses the right side slope.

Set the insertion side either by *right-clicking* on the fragment in the toolbox, or setting the default insertion side. This is done using the **Options => Default Fragment Insert** command in the fragment toolbox.

What happens next depends on how the fragment macro was programmed. Most fragments that add surfaces store the new surfaces in the output cross section file according to the macro logic, input parameters, and geometric conditions, then shift the hook points to the end of the surface so that it is ready to insert the next fragment.

If you insert a fragment using “both”, the fragment is actually inserted twice; once to the left and once to the right, in that order.

To recap this process:

- Find the fragment you want in the Fragment Toolbox
- Modify the input values to match your design
- Choose which side(s) to insert the fragment on
- *Double-click* or *right-click* on the fragment to insert

UNDOING A FRAGMENT INSERTION

You can undo the fragment insertions one at a time in reverse order with the command **Fragment => Undo**. This reconstructs the entire surface with the last fragment removed from the insert list. Remember that inserting a fragment on both sides counts as two insertions; the first to the left and the second to the right. If you want to undo a fragment inserted on both sides, you must select the **Undo** command twice.

MODIFYING A FRAGMENT

Invariably, you will find yourself towards the end of developing an elaborate roadway section with a large number of fragments, only to discover that one of your first fragments has a bad value.

You can modify a single fragment regardless of where it is at by selecting **Fragments => Modify**. Snap on the fragment you wish to change and accept it. The Fragment Modify dialog displays with a list of values entered for that fragment. Change the errant value and *click* **Modify**.

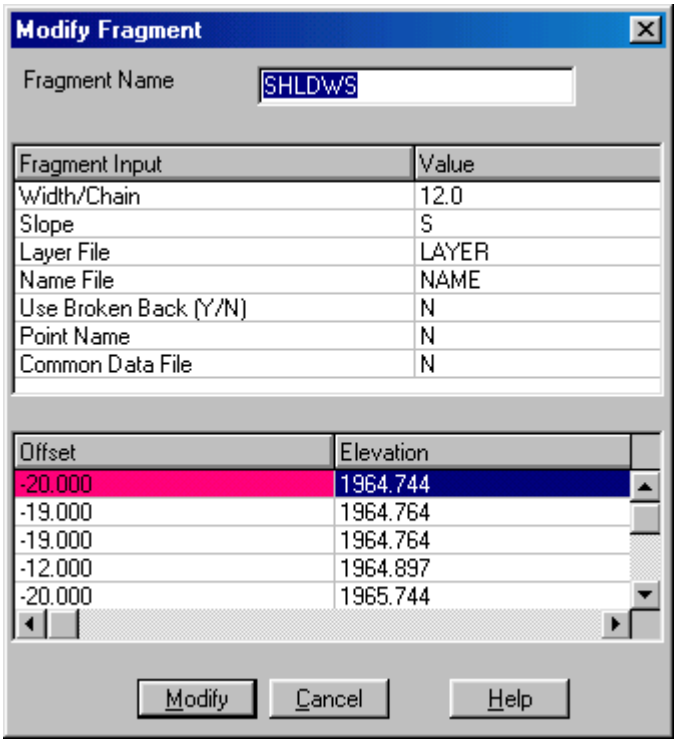


figure **FRAG3-3**: Fragment Modify dialog.

RESETTING A STATION

The command **Fragment => Reset** deletes the surfaces from all fragments inserted at the current station or through a range of stations during your current design session. This command should only be used if you want to start completely over on the design for that station or stations.

STATION TEMPLATES

As soon as the first fragment is inserted, CAiCE creates two files called *template.vrd* and *template.vrs* located in the project directory. These files are ASCII format text files that CAiCE uses to record each fragment (in sequence) that is inserted into the current station.

The **template.vrd** file stores the list of fragments used in a single station. This is considered the Station Template file.

The **template.vrs** file lists all the fragments used for a number of stations. This is considered the Design Template file. We'll talk about this template later.

Once an entire station has been completed, it is a good idea to save your work. Without saving it, the next station requiring the same fragments would take the same time to develop the same fragments. That doesn't sound very efficient.

Instead, upon completing a station, select **Macro => Save Template**.

This command makes a copy of the *template.vrd* file and lets you assign it a name. Now, you may create one template based on representative stations for each condition along your alignment.

For example, you may have a standard lanes template to start, a barrier configuration, then a wall on the right side, then back to a standard lane configuration. Four templates that cover a long range of stations.

To run a template, select the command **Macro => Run Template**. This displays the Open File dialog box pointing to all of the template files in the project directory, but you can use the browse tools to select one from any folder.

It is important to note that you do not want to use the *template.vrd* file for proposed cross-section development. This file changes each time you begin a new station fragment set and is a temporary backup only.

After you select a template, set the beginning and ending station with the Apply Design dialog box. See figure FRAG3-4.

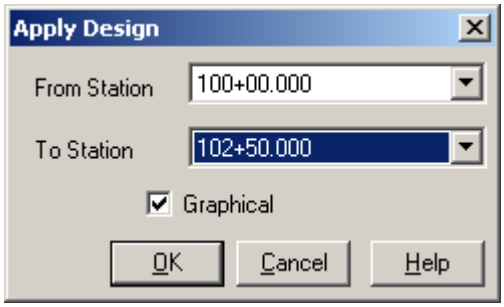


Figure **FRAG3-4**: Apply Design Dialog Box

The **From Station** and **To Station** defaults to the current section station for single station template design, but you can select any stations in the cross-section file from the pull-down lists.

Be careful not to apply the template to the current station if you have already inserted the fragments there. This will attempt to add the fragments to the currently placed fragment set wherever the hook points are located. Most likely, this will result in an error in finding the width chains and other geometry.

When running a template over a large station range, it is helpful to see the templates being drawn at each applicable station. If this isn't a priority you may toggle the **Graphical** box off. In this situation, the Design Roadway X-Sections display remains at the current station while the fragments get applied to the rest of the station range. This decreases the time it takes to process the requested station list, since there aren't any graphics to generate. In the past, this was very helpful with large station ranges. The current VBA fragments runs quite a bit faster than the previous library, so the Graphics/No Graphics difference in speed is pretty nominal.

EDITING TEMPLATES

CAiCE includes a template editor that allows you to modify fragment input parameters and save the template as a different file. You cannot insert fragments into this editor.

To edit a template, select **Macro => Edit Template**. The Template (.vrd) File Editor dialog box is displayed.

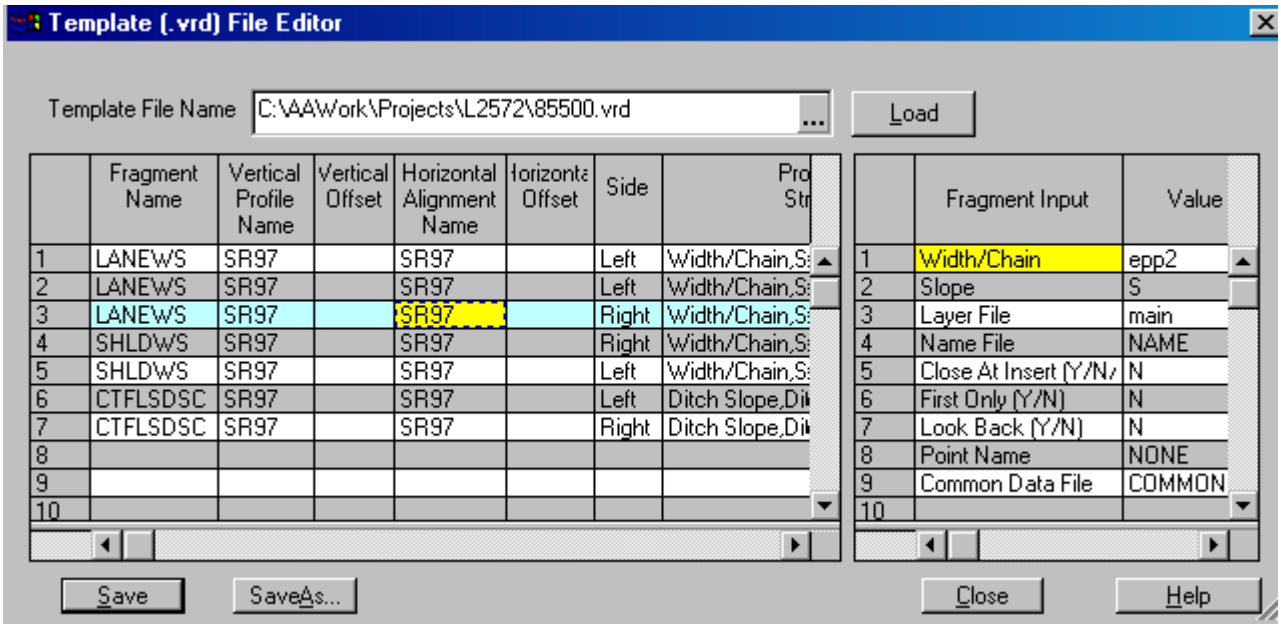


Figure **FRAG3-5**: Template (.vrd) File Editor Dialog Box

DESIGN TEMPLATES

Once you have created station templates for each roadway condition along your alignment, start a fresh Visual Roads session and run the templates across all applicable stations. This produces a "start to finish" cross-section file with information applied to each station.

Use the **Macros => Save Design** tool to record all the fragments placed at each station for the whole proposed range.

The design template is an ASCII text file version of the graphical cross-section endarea file. This file can be used to recreate the EAR file if something should happen to it, or conditions changed such as:

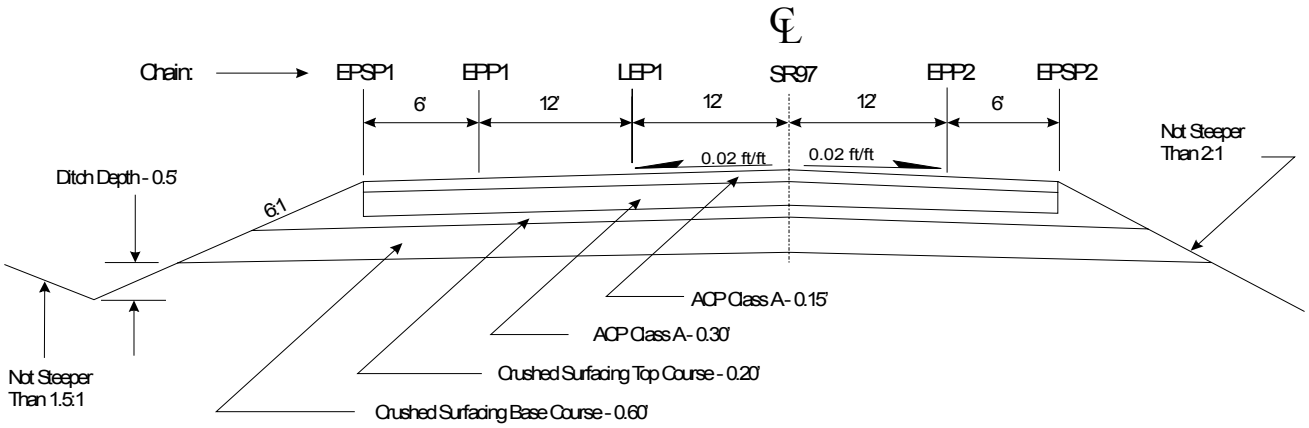
- Additional Survey was collected and the existing surface has changed

- or -

- The alignment geometry has changed and new cross-sections must be run

To run a design template in the Visual Roads session, select the **Macros => Run Design** tool. Confirm that you want to run the macro file (*.vrs), and watch it go.

ROADWAY SECTION FOR EXERCISES



Roadway Section A
Sta. 854+00 to 882+00

Figure **FRAG3-6**: Sketch of roadway section for exercises

EXERCISE 2 - DESIGNING THE ROADWAY

We will create a set of mainline parameters to be referenced for all of our mainline fragments. Then we will create typical roadway section templates to apply to ranges of stations. Lastly we will save the complete design to be used later.

COPY PROJECT FILES MACRO

As we mentioned after creating a WSDOT CAiCE project, WSDOT CAE has developed a CopyProjectFiles toolbox for the Toolbox Explorer. If you haven't already, run this macro to copy WSDOT resources from the \CAE_RSC\ProjFiles folder into your project file, including the default parameter files that you will use in this process.

You only need to run this once.

1	Select CAiCE's Toolbox Explorer. Select the **Window => Explorer Center/Snap Bar** command to toggle this feature on if it is not already visible on your graphics screen.
2	Highlight the CopyProjectFiles toolbox
3	Either *double-click* to launch the macro, or *single-click* and select the **Open** button to launch the **Copy Project Tools** utility.
4	Expand the *Copy* category to view the Copy Project Files tool.
5	*Right-click* on Copy Project Files and select **Insert Object**. You can also *double-click* on the macro.
6	*Click* on the **Copy Default Files into Project Folder** button, then close the macro. This creates a **PRM** subfolder in your project and loads the default fragment parameter files into this folder.

PARAMETERS

1	Get into a **Design Roadway X-Sections** session using the steps in Exercise 1
2	Use the pull down station list and go to station **854+00.00 1** - where our project begins
3	On the **Design Roadway** toolbar *click* the **?** icon to activate the Fragment Toolbox
4	*Click* on the **+** next to **Parameters** and choose the **PARAMETERS** fragment Following the instructions in the Parameter field, *right-click* and select **Insert Object** or *double-click* on **PARAMETERS** to open the Save or Edit Parameter Files dialog box
5	Load the existing **COMMON** parameters file. Note the values and settings default text settings and **Show Errors**

	What other default Common/Text parameter files are available?
6	Select the **Layer Depths** tab

According to our typical section, we will have four layers of material on the left and right mainline roadway sections:

L1 (ACP-WR)	0.15
L2 (ACP-LV)	0.30
L3 (CSTC)	0.20
L4 (N/A)	0.00
L5 (CSBC)	0.60

We will name this layer parameter "Main" to separate this configuration from other future ramp, or cross street sections.

Remember to save a **Lane** file, a **Shoulder** file, and a **Slope** file:

7	Type **MAIN** in the ***Save File(s)*** *Layer File* fields. Main is used for the mainline roadway materials configuration. If you were designing a ramp, you could create another parameter set called RAMP.
8	Select the *Lane* and *Shoulder* check boxes in the **File Type** area, and *click* the **Save** button
9	Deselect the Lane and Shoulder boxes and toggle on the **Slope** box
10	Add the depths of Layers L1 + L2 + L3 and enter that into L3 for both left and right layers We are going to stop using ACP (L1 and L2) at the EPSP. The ditch slope will be L3 material with a maximum depth of **0.65**' on top of the L5 material (0.60'). For L1 and L2 in both Left and Right Layers Enter a **0.00**. This nulls out the two layers. These two layers will be closed off in the slope parameter file.
11	*Click* on the **Save** button

We will be using the default surface names to make development easy to maintain.

12	Select the **Surface Names** tab Select the **Name** file in the **Lane** dropdown list and note the default surface names
13	Select the **Name** file in the **Shoulder** dropdown list and note the default surface names
14	Select the **Name** file in the **Slope** dropdown list and check the **Slope** File Type box Change the **TCS** surface names to **S3** and the **BCS** surface names to **S4** Remember that we had 4 layers and did not use L4. To follow through with this configuration we need to adjust the Top Course Shoulder and Base Course Shoulder to indicate the number of surfaces we have.
15	Toggle the *Slope check box* **on** and *click* on the **Save** button to save the Slope Surface

	parameter file, overwriting the default slope NAME file

The last parameter process saves the Slope Criteria parameter file. This file controls the Cut and Fill slope fragments that look at the relationship between the proposed EPSP and the existing ground for their behavior.

16	Select the **Slope Criteria** tab Change the Steep Cut Slope value to **1.5** Change the Shallow Fill Slope value to **–5**
17	*Click* on the **Save** button overwriting the default SLOPES file, then **close** the dialog box

INSERTING A TEMPLATE TO MATCH THE EXISTING ROADWAY

Lanes:

18	Expand the **+Lanes** category in the Fragment Toolbox and select **LANEWC** for inserting a **LANE** with **W**idth and **C**alculated slope. Change the Width/Chain to **LEP1** - you can also use the picker in that field to select the chain from the database Change the Slope Check Width/Chain to **12** Slope Surface is **EXIST** Change the Layer File to **MAIN**
19	*Right-click* on the **LANEWC** fragment and select **Insert => Left**
20	We will use the same fragment to insert the remaining lanes on this station (**854+00**) Change the Width/Chain value to **EPP1** *Right-click* on the **LANEWC** fragment and select **Insert => Left** Change the Width/Chain value to **EPP2**. This is the right side Edge of Pavement *Right-click* on the **LANEWC** fragment and select **Insert => Right**

Shoulders:

21	In the Fragment Toolbox, expand the **+Shoulders** category and choose **SHLDWC** for inserting a Shoulder by Width and % Slope/Superelevation. Change the Width/Chain value to **EPSP2** The Slope Check Width/Chain = **5.0** Change the Layer File to **MAIN** Use Broken Back (Y/N) = **N** This parameter indicates whether or not you want the high side subgrade shoulder to break over to a negative slope. We will not be using the broken back feature in this exercise. With the **SHLDWC** fragment highlighted, select **Insert => Right** Change the Width/Chain value to **EPSP1** With the **SHLDWC** fragment highlighted, select **Insert => Left**

Slopes:

22	In the Fragment Toolbox, expand the **+Ditch Slopes => Cut Or Fill** category and choose **CTFLSDSC** for inserting a **C**UT/**F**I**L**L slope with a ditch **S**lope/**D**epth and **S**lope **C**riteria. We want to use the defaults with the exception of the Ditch Slope and Layer File. For more information on the options for this type of fragment, view the fragment's description in the toolbox. The Ditch Slope is **–6**. This slope is from the finished EPSP to the Ditch Reference Point (DRP) also known as the Ditch Bottom. The Layer file is **MAIN** When you are approaching the ROW boundary, you can allow the fragment to warp the catch with relationship to the ROW boundary. This fragment allows you to mark or name various key points, such as Subgrade Shoulder (SGS) and Ditch Reference Point (DRP) for future use. With the **CTFLSDSC** fragment highlighted, select **Insert => Both**

Once you have the entire station completed, you can save it as a template macro for later use. Prior to saving it, it is recommended that you check it for quantity calculation potential.

> **TECH TIP:** When you close the Fragment Toolbox, you will be prompted with this **Save Changes** message: "Some of the value in the database have been changed. Do you wish to save the changes?" If you plan to use the same fragment input parameters in your next roadway design session, you can select Yes.

23	Select **Settings => Display Areas** Each area that is defined by two or more surfaces meeting to form a closed polygon can be calculated for its area. The colors indicate every area of the roadway section that can be used for quantity calculations.

Save this template:

24	On the CAiCE pull down menu, select **Macro => Save Template** Save this file as **85400.vrd** in the project directory

The **Apply => Next Station** is a great tool to find if the section will work on a short range of stations. However, it should be not be used for more than three to four stations.

25	Select the **Apply => Next Station** from the pull down menu The cross-section file will move to station 854+50.000 and apply the *template.vrd* file
26	Run this template over the next three stations: Select **Macro => Run Template** and select the **85400.vrd** template file Set the station range from 855+00.000 to station 855+50.00 and *click* **OK**

We will create a station template that will apply our roadway section just as the previous exercise, except that this template will utilize the proposed superelevation table for SR97 instead of matching the existing surface.

Reference the roadway section on page 81 for the typical roadway section.
We will use the same parameter files created in the previous exercise.

27	If the Fragment Toolbox is closed, select the **?** icon on the Design Roadway Toolbar
28	In the Design Roadway X-sections session, browse to station **856+00.00**

Lanes:

29	Expand the **+Lanes** category in the Fragment Toolbox and select **LANEWS** for inserting a **LANE** with **W**idth and % **S**lope / Superelevation table.
30	A numeric slope can be entered by typing 0.02 for 2% or –0.10 for –10%. If a superelevation table has been stored for the horizontal alignment, an **S** will tell CAiCE to refer to the table for superelevation values. Change the Width/Chain to **LEP1** Use the default slope value of **S** Change the Layer File to **MAIN** With the **LANEWS** fragment highlighted, *right-click* and select **Insert => Left** Revise the Width/Chain to **EPP1** Insert the fragment on the **Left** side Revise the Width/Chain to **EPP2** Insert the fragment on the **Right** side

Shoulders:

31	Expand the **+Shoulders** category and select **SHLDWS** for inserting a Shoulder with Width and % Slope / Superelevation table Change the Width/Chain to **EPSP2** Change the Layer File to **MAIN** Change Use Broken Back (Y/N) to **N** Insert the fragment in the **Right** side Revise the Width/Chain to **EPSP1** Insert the fragment on the **Left** side

Slopes:

32	In the Fragment Toolbox, expand the **+Cut/Fill** category and choose **CTFLSDSC** Use a Ditch Slope of **-6** Insert the fragment on the **Both** sides

Save the template:

33	Select **Settings => Display Areas** Verify that all the roadway areas are colored in
34	On the CAiCE pull down menu, select **Macros => Save Template** Save this file as *85600.vrd* in the project directory

Run the template:

35	Browse to the next station - **856+50.000** Select the **Macros => Run Template** command Find the template file *85600.vrd*, and click **Open** The start station is at 856+50.000 Set the last station to 881+00.000. Keep the **Graphical** option checked, and *click* on **OK**
36	*Click* **OK** through any errors that you encounter – you will come back and fix the problems at the specific stations later

Since we are running the roadway templates in order, we can finish the design by running the template we created in the previous exercise on the remaining stations. This project has one roadway section to build, and two templates:

- **85400.vrd** for matching existing conditions.
- **85600.vrd** for using design superelevations to control the work.

At station 881+50, we could build a template from scratch that would match the existing condition at the end of the project. This would be identical to the template we made at the beginning of the project 854+00 to 855+50.

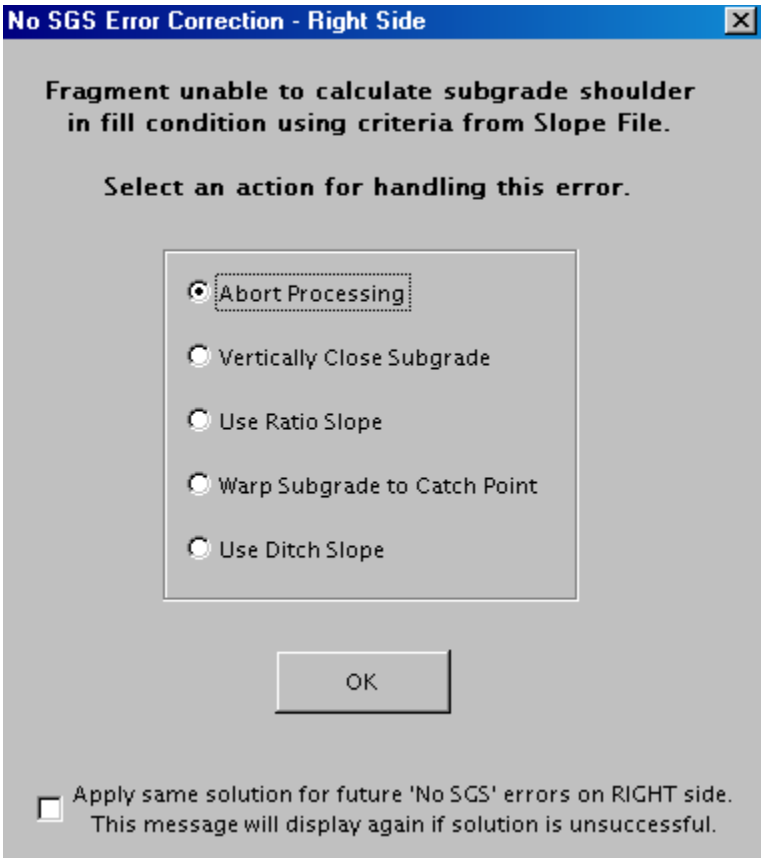
- Or -

We can make a copy of the **85400.vrd** and rename it to indicate the first station we use it on.

37	In CAiCE, move forward to station **881+50.000**, then select the **Macros => Run Template** Highlight the **85400.vrd** file and use your *CTRL-C* keys to make a copy of this file. Use your *CTRL-V* key to paste that copy into the project directory, then rename the new file to **88150.vrd**. You can also use the right-click menu to copy and paste the file
38	Select the template file **88150.vrd**, and *click* **Open** The start station is at **881+50.000** Change the end station to **882+00.000** and *click* **OK**

At station **882+00**, you receive the dialog message shown below. This indicates that there is an issue with the fragment you are attempting to insert that doesn't work. Based on the values we set, the **CTFLSDSC** fragment could not effect the ditch slope we wanted with the **EXIST** surface.

The error dialog allows you to address the issue with some potential fixes. Not all are applicable or appropriate for all cases, but at least it gives you a starting point.



In our design, we have two plausible options: Abort Processing, or Vertical Close Subgrade.
We will select **Abort Processing** and fix the fragment values.

39	Select the **Abort Processing** radio button and *click* **OK** This halts the process of applying your template and allows you to manually insert or modify fragments at the current station before proceeding Vertical Close Subgrade creates a vertical link to close the roadway materials. Then it attempts to use the SLOPE parameter to catch the template to EXIST surface.
40	Zoom in to the right side of the roadway and take a look at what we have. We are using a fragment that analyzes the relationship between the proposed roadway surfaces and the EXIST surface and acts effects a cut with ditch and catch or fill to catch, accordingly.

This fragment starts out at the EPSP in a FILL condition, but the subgrade is below the EXIST surface, so it's a CUT, right? But, the subgrade shoulder projects out above the EXIST, so that would be in a FILL…

This doesn't happen very often, but it has to do with the ditch slope ratio, subgrade projection to shoulder, and the existing surface. The number of times the fragment can change behavior as it travels along the ditch slope can limit it's ability to catch successfully.

41	In the Fragment Toolbox, take a look at the values we are using for **CTFLSDSC**. About the only value listed that would change the subgrade catch with the ditch slope is the ditch slope itself. When experimenting, start at one extreme and move toward the original value
42	You will receive an error message: "Fragment data in memory is missing or not valid. Check to make sure there is a lane fragment inserted prior to the current hook (or insertion) point." This message occurs when there is a change to a fragment and the hook point locations are not updated in 'memory'. CAiCE included this feature so that the hook points would be positioned at the last insertion point if the fragment was reset or modified. In this case, the fragment was not able to be inserted on the right side because the ditch slope would not catch at a shallow –6. To trick the fragment into 'remembering' the hook point locations in this situation, we can simply modify the last fragment on the right side. Select **Fragment => Modify** and snap to the right shoulder fragment. You don't need to change any values – just *click* **Modify** to close the dialog box. Review the results If they are not acceptable, select **Fragment => Undo** from the pull down menu Revise the fragment values until they are acceptable
43	Change the Ditch Slope value in the **CTFLSDSC** fragment to **–1** Click on **Select**, and insert the fragment on the **Right** side Review the previous errors that you received by viewing the log file. *Click* on the **Report File** icon, navigate to the log file, and open it in your default text editor. The log file is the name of your active endarea file, with the ***.log** extension

Save the design. Once you have applied a template to the entire station range in your design, you can save the entire design in a template macro form similar to the station template macro.

44	Select **Macro => Save Design** Save this file as **SR97_fin.vrs** in the project directory
45	Complete the exercise by selecting **File => Close** to exit the Design Roadway X-sections session Select **Yes** at the CAiCE prompt "Do you want to exit?" If you have opened this file in a previous session, CAiCE may prompt you to overwrite a VRB file. Select **OK**. This is a type of backup file that gets rewritten each time you run the **Design Roadway X-section** session for that file.

SUMMARY

We have introduced and discussed the major fragment categories in the WSDOT fragment library. This collection of fragments allows the designer to build virtually any roadway configuration.

We described the function of the parameter fragment files. These files must be stored prior to using other fragments as they contain information that other fragments need to do their job. Default parameter files are located in the \PRM subfolder in your project.

We also talked about the various types of roadway fragments including Lanes, Shoulders, and Slopes.

Building typical roadway section templates allows you to develop large stations ranges at one time.

WSDOT VB fragments will let you know when they encounter a condition that the parameters will not work with. This gives the operator a chance to troubleshoot that station with given options.

Fragment Naming Conventions

This chapter describes the naming scheme for VBA fragments. This scheme applies for all fragments except certain structural type fragments such as barriers. The scheme for barrier fragments will be described after the tables for all the other fragments are defined.

GROUPING CATEGORIES

GROUPING	DESCRIPTION
CRBG	curb and gutter fragments
CTFL	cut and fill condition fragments
CURB	curb fragments
CUTT	cut condition only fragments
FILL	fill condition only fragments
GDRL	guardrail fragments
GORE	gore area fragments
LABL	fragments which place labels in the end area file
LANE	lane fragments
LINK	simple link fragments
MEDN	median fragments
MSEW	mechanically stabilized earth wall
MVHK	fragments for moving the hook points
PLAN	planing fragments
SHLD	shoulder fragments
SLOP	side slope fragments with no regard for cut or fill
SWLK	sidewalk fragments
WALL	retaining wall fragments

OFFSET QUALIFIERS

QUALIFIER	DESCRIPTION
W	fixed **W**idth or geometry chain
G	**G**eometry chain required
S	**S**lope, i.e. run at given slope until reach a pre-determined elevation
O	fixed **O**ffset as measured from centerline +/- or geometry chain
L	surface **L**imit
D	**D**elta offset
F	**F**eature code
C	run until **C**atch on a specified surface is found

X	intersection of two links defines width
T	cen**T**er point between two points
H	**H**ook chain or center between two points
_	means this qualifier does not apply

ELEVATION QUALIFIERS

QUALIFIER	DESCRIPTION
S	percent slope or **S**uperelevation table
R	**R**atio slope
V	sur**V**ey chain
P	**P**rofile
C	**C**alculated slope
L	**L**ook back, slope retrieved from earlier fragment
H	current **H**ook point location
M	**M**arked point
F	pro**F**ile or percent slope or superelevation table
E	**E**levation taken from a surface
D	**D**epth (ditch depth below subgrade) or delta elevation +/-
W	cro**W**n
A	**A**ny slope allowed, ratio or percent
U	Percent slope or s**U**perelevation table or look back slope
_	means this qualifier does not apply

MISCELLANEOUS QUALIFIERS

QUALIFIER	DESCRIPTION
SC	**S**lope **C**riteria, i.e. multiple slopes with height restrictions
ML	**M**ultiple catch or **L**ast catch
BC	**B**erm option with slope **C**riteria
BB	**B**roken **B**ack
LB	**L**ane with **B**roken back precedes
BP	**B**ench **P**attern
BS	**B**ench pattern with **S**lope criteria
MG	**M**ultiple catch or last catch with **G**uardrail option
CR	**C**oncrete block retaining wall with **R**oadway surfaces
CS	**C**oncrete block retaining wall with **S**idewalk
NB	**N**o **B**arrier or layers
BL	**B**arrier and **L**ayer
#N	retaining wall type **# N**o layers (replace # with number from 1-6)
#L	retaining wall type **#** with **L**ayers (replace # with number from 1-6)

CF	**C**ut or **F**ill condition is checked to modify behavior
SP	**S**oldier **P**ile wall
SL	**S**oldier pile wall with **L**ayers
SN	**S**oldier pile wall with **N**o layers
PS	**P**lanting **S**trip
NS	**N**o layers and **S**lope criteria
SM	**S**tarts from a **M**arked point
AP	**A**rray of **P**oints
SF	**S**lope criteria, ditch measured from **F**inished shoulder
NL	**N**o **L**ayers
FM	**F**lat bottom **M**edian
MB	**M**edian **B**arrier
LN	**L**a**N**e type fragment
PB	**P**ermial **B**ase drain
SH	**SH**oulder type fragment
LC	**L**ayer **C**losure
BF	median **B**arrier with **F**ixed height
DB	**D**ouble **B**arrier

GML TO VBA TRANSLATIONS

To help transition between the previous fragment library (GML) and the new one (VBA), the table below shows equivalent fragments in the two libraries.

GML	VBA
BARRIER1	LINKWDAP (use default point file)
CRBGWC	CRBGWC
CRBGWL	CRBGWL
CTFLSDSF	CTFLSDSF
CURB1	CURBWS
CURB2	CRBGWS
DELTAXY	MVHKDD
EW1	CTFLSDSC
EW10	SLOP_M
EW11	SLOPSD
EW12	SLOP_V
EW1B	CTFLSDBC
EW2	CTFLGPSC
EW3	CUTTSDML
EW4	CUTTGPML
EW5	FILLCRMG
EW6	CTFLSDNS
EW7	SLOPGP
EW8	CTFLSPSC
EW9	SLOPWR
GORE1	GORETR

GML	VBA
GOTOMK	MVHK_M
GR1	GDRLWL
LABELCL	LABL_E
LABELCP	LABLGP
LABELRW	LABLOD
LANE1	LANEWS
LANE2	LANEGP
LANE3	LANEWC
LANE4	LANEWL
LANE5	LANE_V
LANEPBD	LANEWCPB
LANEWSBB	LANEWSBB
LINK1	LINKWS
LINK10	LINKSD
LINK2	LINKWR
LINK3	LINKCRML
LINK4	LINKCC
LINK5	LINK_M
LINK6	LINKGP
LINK7	LINKCRCF
LINK8	LINK_V

GML	VBA
LINK9	LINKOE
LINKINT1	LINKXA
LINKINT2	LINKXRFM
LINKSP	LINKSP
MEDBAR1	MEDNHUMB
MEDIAN1	MEDNSD
MEDIAN2	MEDNTD
MVHKCP	MVHKGP
MVHKCRWN	MVHKWW
MVHKCS1	MVHKWS
MVHKCS2	MVHKWR
MVHKFC	MVHKFE
MVHKLIM	MVHKLE
MVHKSRF2	MVHKDE
MVHKSURF	MVHKOE
PLANE1	PLANWD
PLANE2	PLANWD
PLANE3	PLANCD
RBENCH	CUTTWRBS
RWALL1	WALLWF1L
RWALL1	WALLWF1N

GML	VBA
RWALL2	WALLWF2L
RWALL2	WALLWF2N
RWALL3-6	WALLWF3N
RWALL3-6	WALLWF4N
RWALL3-6	WALLWF5N
RWALL3-6	WALLWF6N
RWCBLK1	WALL_HCR
RWMSE1	MSEWWFBL
RWMSE2	MSEWWFNB
SHLD1	SHLDWS
SHLD2	SHLDGP
SHLD3	SHLDWC
SHLD4	SHLDWL
SHLD5	SHLD_V
SHLDPBD	SHLDWLPB
SHLDWSLB	SHLDWSLB
SWALK1	SWLKWSPS
VLINK1	LINK_D
VLINK2	LINK_E
WALLWLSP	WALLWLSL
WALLWSSP	WALLWSSL

NEW VBA FRAGMENTS

The following fragments are new to the VBA library.

NEW VBA FRAGMENTS
PARAMETERS
CURBWC
CURBWL
CUTTSDCZ
LANE_M
LINK_MSM
LINKWDAP
LINKFE
LINKWW
LINKWL
MVHK_V
SHLD_M
WALLWLSN
WALLWSSN

BARRIER FRAGMENT NAMING

Barrier fragments are named differently than the other fragments. Since barriers rest atop other surfaces, they effectively would always use the offset elevation code type **OE**. To better distinguish between various barrier types and modifications, the name for barrier fragments will be as follows: the page number from the standard plans manual, followed by an underscore, followed by information on the type and section from the standard plans. For example, the fragment to place a Type 4 Concrete Barrier of type Section A-A would be named C8A_4AA. This is known to be a barrier fragment since it is placed in the Barriers category of the fragment selection dialog box.

FRAGMENT REQUESTS

Our current WSDOT CAE library contains a sufficient number of fragments to define most conditions, but new fragments may be requested to handle specific situations. If you have a need for a new fragment or ideas about enhancing existing fragments, find our Fragment Request form at:

http://www.wsdot.wa.gov/eesc/cae/CAiCE/caice.htm

Download the Fragment Request form and use it to help describe the enhancement or new condition. Submit the form to your regional CAiCE Coordinator.

This form helps us identify required specifications, potential conditions, and other criteria. Some of the considerations are:

- The priority
- Is this a fix or enhancement to an existing fragment, a fragment description or a new fragment?
- What is the existing fragment name, and what is the error?
- What type of new fragment is being requested?
- Provide a sketch in hardcopy, MicroStation DGN or another format with a description of each configuration/situation the fragment will be used in, an illustration of each configuration/situation and all necessary labels
- Will construction staking information be generated from this fragment?
- What quantities will this fragment generate or apply to?
- What are the parameters or variable inputs?
- A description of each configuration, parameter and situation associated with this fragment.

CURRENT WSDOT FRAGMENTS

AS OF MARCH, 2004

Parameters	
PARAMETERS	Create, edit or delete a fragment parameter file
Common/Text	The Common/Text parameter fragment saves labeling and error message preferences to a file that can be referenced in other fragments
Layer Depths	The Layer Depths parameter fragment is used to edit and save a layer thickness file that can be referenced in other fragments
Surface Names	The Surface Names parameter fragment is used to edit and save a surface name file that can be referenced in other fragments
Slope Criteria	The Slope Criteria parameter fragment is used to edit and save cut and fill slope criteria preferences for multiple catch options that can be referenced in other fragments
Lanes	
LANE_M	Lane calculated by a marked point
LANE_V	Lane calculated by a survey chain
LANEGP	Lane calculated by a geometry chain and a profile
LANEWC	Lane calculated by a width and the calculated slope
LANEWCPB	Lane calculated by a width and the calculated slope with a permeable base drain
LANEWL	Lane calculated by a width and the look back slope
LANEWS	Lane calculated by a width and percent slope or superelevation
Shoulders	
SHLD_M	Shoulder calculated by a marked point
SHLD_V	Shoulder calculated by a survey chain
SHLDGP	Shoulder calculated by a geometry chain and a profile
SHLDWC	Shoulder calculated by a width and a calculated slope
SHLDWL	Shoulder calculated by a width and a look back slope
SHLDWLPB	Shoulder calculated by a width and a look back slope with a permeable base drain
SHLDWS	Shoulder calculated by a width and a percent slope or superelevation

Ditch Slopes - Cut	
CUTTGPML	Cut ditch calculated by a geometry chain and a profile with a multiple catch option
CUTTSDCZ	Cut ditch slope with a clear zone and ditch point defined by a ratio slope and a depth below subgrade
CUTTSDML	Cut ditch slope with a multiple catch option defined by a ratio slope and a depth below subgrade
CUTTWRBS	Cut ditch in a rock bench pattern with a ditch point defined by width ratio slope and a fixed width or a geometry chain
Ditch Slopes - Cut Or Fill	
CTFLGPSC	Cut or fill side section with a ditch defined by a geometry chain and profile using slope criteria for a catch slope
CTFLSDBC	Cut or fill side section with a berm in ditch defined by depth below subgrade and using slope criteria for a catch slope
CTFLSDNS	Cut or fill side section with a ditch defined by the depth below subgrade using slope criteria and no surface layers
CTFLSDSC	Cut or fill side section with a ditch defined by the depth below subgrade and slope criteria for the catch slope
CTFLSDSF	Cut or fill side section with a ditch defined by the depth measured from finished shoulder and using slope criteria for the catch slope
CTFLSPSC	Cut or fill side section with a ditch defined by the depth below subgrade and using slope criteria for the catch slope
Side Slopes	
SLOP_M	Side slope to a marked point
SLOP_V	Side slope to a survey chain
SLOPGP	Side slope to a geometry chain and profile
SLOPSD	Side slope to a ditch slope and depth
SLOPWR	Side slope to a width and a ratio slope
Side Slopes - Fill	
FILLCRMG	Fill side section with a multiple catch option and the option for a guardrail per WSDOT Design manual cases 4-6
Curb	
CRBGWC	Curb calculated by a width and calculated slope
CRBGWL	Curb calculated by a width and a look back slope
CRBGWS	Curb calculated by a width and percent
CURBWC	Curb calculated by a width and a calculated slope
CURBWL	Curb calculated by a width and a look back slope

CURBWS	Curb calculated by a width and percent
Sidewalks	
SWLKWSPN	Inserts a WSDOT standard concrete sidewalk by width and a percent slope with a planting strip option - designed to function when not immediately following a curb or curb/gutter fragment
SWLKWSPS	Inserts a WSDOT standard concrete sidewalk by width and percent slope with a planting strip option
SWLKWSSW	Inserts a WSDOT standard concrete sidewalk by width and percent slope with a bio swale
Medians	
MEDNHUBF	Median with multiple surface layers and a single slope barrier to a fixed height
MEDNHUDB	Median with multiple surface layers and double barriers with fill and cover
MEDNHUMB	Median with multiple surface layers and a single slope barrier
MEDNSD	Median to a fixed single slope and depth below the lowest subgrade shoulder
MEDNTD	Median with a common point centered between the finished shoulders and located at a minimum depth below the lowest subgrade shoulder
Medians/Gore	
GORETR	Gore with a common point centered between the finished shoulders and one fixed slope
Guardrail	
GDRLWL	Beam Guardrail Shoulder – WSDOT Standard Plan C1
Walls	
WALL_HCR	Concrete block retained earth wall abutting roadway surfaces
WALLWF	Retaining walls type 1-6 per WSDOT Standard Plan sheets D-1a to D-1f calculated by width and profile
WALLWLSL	Soldier pile retaining wall with roadway surfaces defined by width and look back slope
WALLWLSN	Soldier pile retaining wall defined by width and look back slope with no roadway surface layers
WALLWSSL	Soldier pile retaining wall with roadway surface layers defined by percent slope
WALLWSSN	Soldier pile retaining defined by percent slope with no roadway surface layers
Walls - MSE	

MSEWWF	Mechanically stabilized earth retaining wall calculated by a width and a profile with option for barrier and layers together or a wall with no barrier and no layers
MSEWWFWI	A special request fragment for a mechanically stabilized earth retaining wall fragment that is identical to MSEWWF with the exception of surface names and the variable marked point names
Links	
LINK_D	Vertical link to a delta elevation
LINK_E	Vertical link to a surface
LINK_H	Vertical link surface closure at the current hook point
LINK_M	Link calculated by a marked point
LINK_MSM	Link to a marked point starting from a marked point
LINK_V	Link to a survey chain
LINKCC	Link from a catch at the matching slope on an existing surface
LINKCRCF	Cut or fill link from the current hook to catch at specified slope
LINKCRML	Link from the current hook to multiple or the last catch at a specified ratio slope
LINKFE	Link to a feature code on a surface
LINKGP	Link to an offset geometry chain and a profile
LINKOE	Link to an offset on a surface
LINKOXSI	Link to a fixed offset chain and a fixed elevation or profile with the option to end the link at a surface intersection
LINKSD	Link to a slope and depth
LINKSP	Link to a slope and profile
LINKWD	Link to a width and a delta elevation
LINKWDAP	Link to a width and a delta elevation as an array of points
LINKWL	Link to a width and a look back slope
LINKWR	Link to a width and ratio slope
LINKWS	Link to a width and percent slope or superelevation
LINKWW	Link to a width or chain at the current superelevation slope for the opposite side
LINKXA	Intersection of two links by the slope (percent or ratio) of the links
LINKXRFM	Intersection of two links by the slope joined by a flat bottom median
Hook Points	
MVHK_M	Moves hook point to a marked point
MVHK_V	Moves hook point to a survey chain

MVHKDD	Moves hook point to a delta offset and a delta elevation
MVHKDE	Moves hook point to a delta offset on a surface
MVHKFE	Moves hook point to a feature code on a surface
MVHKGP	Moves hook point to a geometry chain and a profile
MVHKLE	Moves hook point to a limit on a surface
MVHKOE	Moves hook point to an offset on a surface
MVHKSE	Moves hook point to a surface by a slope
MVHKWR	Moves hook point to a width by a ratio slope
MVHKWS	Moves hook point to a width by a percent slope or a superelevation
MVHKWW	Moves hook point to a width or hook and a crown
Labels	
LABL_E	Labels the centerline elevation
LABLGP	Labels an elevation at a chain and a profile
LABLOD	Labels the text at an offset and depth below the hook point
Planing	
PLANCD	Planing of surface by catch at a given depth and slope
PLANWD	Planing of surface by width and depth control
Legacy Fragments	
MSEWWFBL	Mechanically stabilized earth retaining wall calculated by width and profile with a barrier and layers
MSEWWFNB	Mechanically stabilized earth retaining wall calculated by width and profile without a barrier
WALLWF1L	Retaining wall type 1 calculated by width and profile including surface layers
WALLWF1N	Retaining wall type 1 calculated by width and profile with no surface layers
WALLWF2L	Retaining wall type 2 calculated by width and profile including surface layers
WALLWF2N	Retaining wall type 2 calculated by width and profile with no surface layers
WALLWF3N	Retaining wall type 3 calculated by width and profile with no surface layers
WALLWF4N	Retaining wall type 4 calculated by width and profile with no surface layers
WALLWF5N	Retaining wall type 5 calculated by width and profile with no surface layers

WALLWF6N	Retaining wall type 6 calculated by width and profile with no surface layers

Visual Roads Challenges

QUESTIONS

1. What type of information can we get when we compare the proposed geometry to the existing surface?

2. What is the CAiCE tool that we use to design our proposed geometry cross section?

3. What items do you need to begin building your proposed geometry cross section?

4. What is the PGL?

5. What are some typical fragment types?

6. What are the four categories in the parameter fragment?

7. Can you have more than one set of parameter files in your project?

8. Is it necessary to store parameter fragments in your project?

9. What tool do you use to select and insert fragments?

10. What is a template?

11. What is a design file?

12. What does the **W** offset qualifier represent in a fragment name?

13. What does the **S** elevation qualifier stand for in a fragment name?

ANSWERS

1. When we compare the existing surface to the proposed geometry, we can get:
   - A graphical representation of the relationship between existing and proposed elements.
   - The offset distances where the proposed slope-intercept points are (where the outer limits of the -finished roadway template meets the existing surface). This can be critical when Right-of-Way and other boundaries need to be considered.
   - Square areas of any given material for quantity calculations at each station interval.
   - What types of design slopes, ditches, and other roadway features may be chosen or modified to better fit with existing conditions.
2. We use the Visual Roads tool to design our proposed geometry cross-sections.
3. We need these items to build our proposed geometry cross-sections:
   - Horizontal Alignment Geometry Chain
   - Vertical Alignment Design Profile
   - Reference Cross Section File (.EAR), typically developed from the Existing Digital Terrain Model
   - Any geometry that may be necessary to help define the design template. e.g. Superelevations, offset Chains, Right of Way Chains, etc.
   - Our WSDOT resources
   - The WSDOT VBA Fragment Library
4. The Profile Grade Line represents the active design alignment and profile. This (PGL) is the "origin" of all fragments used in the design. When using superelevation tables, this is where it references which superelevation table to use.
5. Typical fragments in our library are WSDOT standard roadway elements (lanes, shoulders, curbs, sidewalks, barriers, retaining walls and side slopes).
6. Common/Text, Layer Depths, Surface Name & Slope Criteria are the categories for WSDOT's parameter fragment.
7. You can have many parameter fragments in your project – these can handle special situation such as ramps, mainline alignments and varying slope criteria.
8. All parameter files need to be accessible from the PRM subfolder in your project because they are referenced by all other fragments. The default parameter files can be found in the PRM folder.
9. We use the Fragment Toolbox to select and insert our fragments.
10. A template is a combination of fragments at a single station that can be applied to multiple stations.
11. A design file is an ASCII text file version of the graphical cross-section endarea file. This file contains information about multiple stations along your alignment.
12. The **W** qualifier represents a fixed **W**idth or geometry chain.
13. The **S** qualifier represents a percent slope or **S**uperelevation table.